Science Library

34.

JANUARY 1941

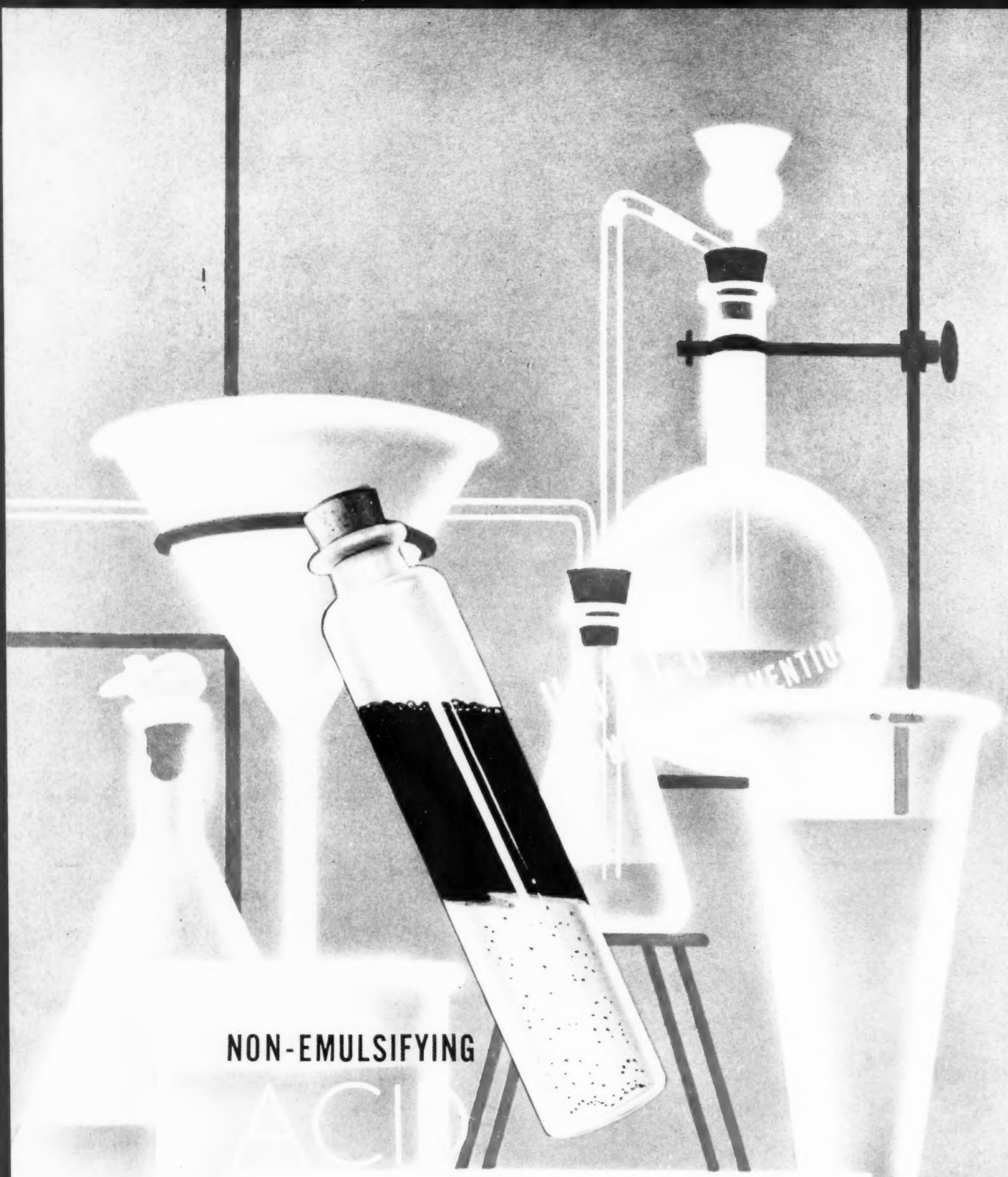
WORLD PETROLEUM

FEB 3 1941

NEW YORK AND LONDON

Outlook for '41

Meisel Photo



NON-EMULSIFYING

When the crude in a well is of a type which forms a stable emulsion with ordinary acid, these problems may arise: inability of the acid to attack the formation effectively, long clean-up periods after treatment and, in extreme cases, decreased production . . . The "ounce of prevention" is Howco Non-Emulsifying Acid, which does what its name implies . . . For interesting pictorial proof, see your Composite Catalog.

HALLIBURTON OIL WELL CEMENTING COMPANY

Science lib.
Taxon

WORLD PETROLEUM

Founded by Russell Palmer

E. W. Mayo
Editor

T. Orchard Lisle
Executive Editor

E. W. Mayo, Jr.
Managing Editor

S. J. Gallay
Advertising Manager

VOLUME 12 JANUARY, 1941 NUMBER 1

WORLD PETROLEUM: Incorporating Petroleum Equipment Exporter

CORRESPONDENCE

ADDRESS all correspondence regarding editorial, advertising, subscription and business matters to the Home Office; 95 River Street, Hoboken, N. J. Telephone Rector 2-2043 or Hoboken 3-2480.

London office; Brettenham House, Lancaster Place, W.C.2.

Los Angeles office; 412 West 6th Street

▼

SUBSCRIPTIONS

ANNUAL subscription to WORLD PETROLEUM is offered at the flat rate of five dollars (U. S.) postpaid to any country in the International Postal Union.

For the convenience of subscribers the publisher will accept payment in any of the following currencies at the fixed rate shown below:

Argentina	4.17 paper pesos
Brazil	58 paper milreis
Canada	5.00 dollars
Colombia	5.00 pesos
France	190 francs
Germany	13 reichsmark
Great Britain	1 guinea
Netherlands	10 guilders
India	15 rupee
Iran	1 guinea
Iraq	1 guinea
Italy	95 lire
Japan	20 yen
Mexico	14 pesos
Peru	6 sol
Poland	27 zloty
Roumania	675 leu
Russia	6 roubles
Venezuela	11 bolivar

REMITTANCES or drafts should be drawn to the order of the Publisher, WORLD PETROLEUM, payable in New York and London.

Subscriber's name and address should be in Roman capitals on the subscription order.

Official position of subscriber is requested.

Advance notice, if possible, of a change of subscriber's address should be given.

CONTENTS

New Federal Control Drive 21

Consumer Demand for 1941 . . . 23

German Occupation of Roumanian Fields 26

Drilling Outlook for 1941 29

Refining Outlook for 1941 33

Financial Outlook for 1941 . . . 36

Use of Lecithin in Gasoline 42

World Crude Production Tables . . 46

Foreign Oil Legion 48

Abstracts 50

AGENCIES

SINGLE copies of WORLD PETROLEUM are obtainable every month, within the delay imposed by the international mail service, at any of the following agencies:

MARACAIBO, VENEZUELA—High Life Tailors.
THE HAGUE, NETHERLANDS—Martinus Nijhoff, Lange Voorhout 9
LONDON—World Petroleum, Brettenham House Lancaster, Place, W. C. 2.
A. C. Hardy, 110 Penchurch St. E. C. 3
W. H. Smith & Sons, Ltd., Moorgate Met. Station
Willing & Co., Ltd., Moorgate Met. Station
Barker & Howard, 6 Fenchurch Buildings, E. C. 3
NEW YORK—Telephone Rector 2-2043 for list of 20 newsstands carrying copies
PARIS—Librarie Brentano, 37 Avenue de l'Opera.
PORT OF SPAIN, TRINIDAD—Davidson & Todd, Ltd., 8 Frederick St.
LOS ANGELES—412 West 6th St., telephone: Mutual 1391.

British subscribers may make payments at the London office of World Petroleum. Monthly copies, two shillings; yearly, one guinea.

▼

PARTICULAR NOTICES

MANUSCRIPTS and photographs submitted to the editor are received only at the owner's risk. Prompt consideration will be given to them.

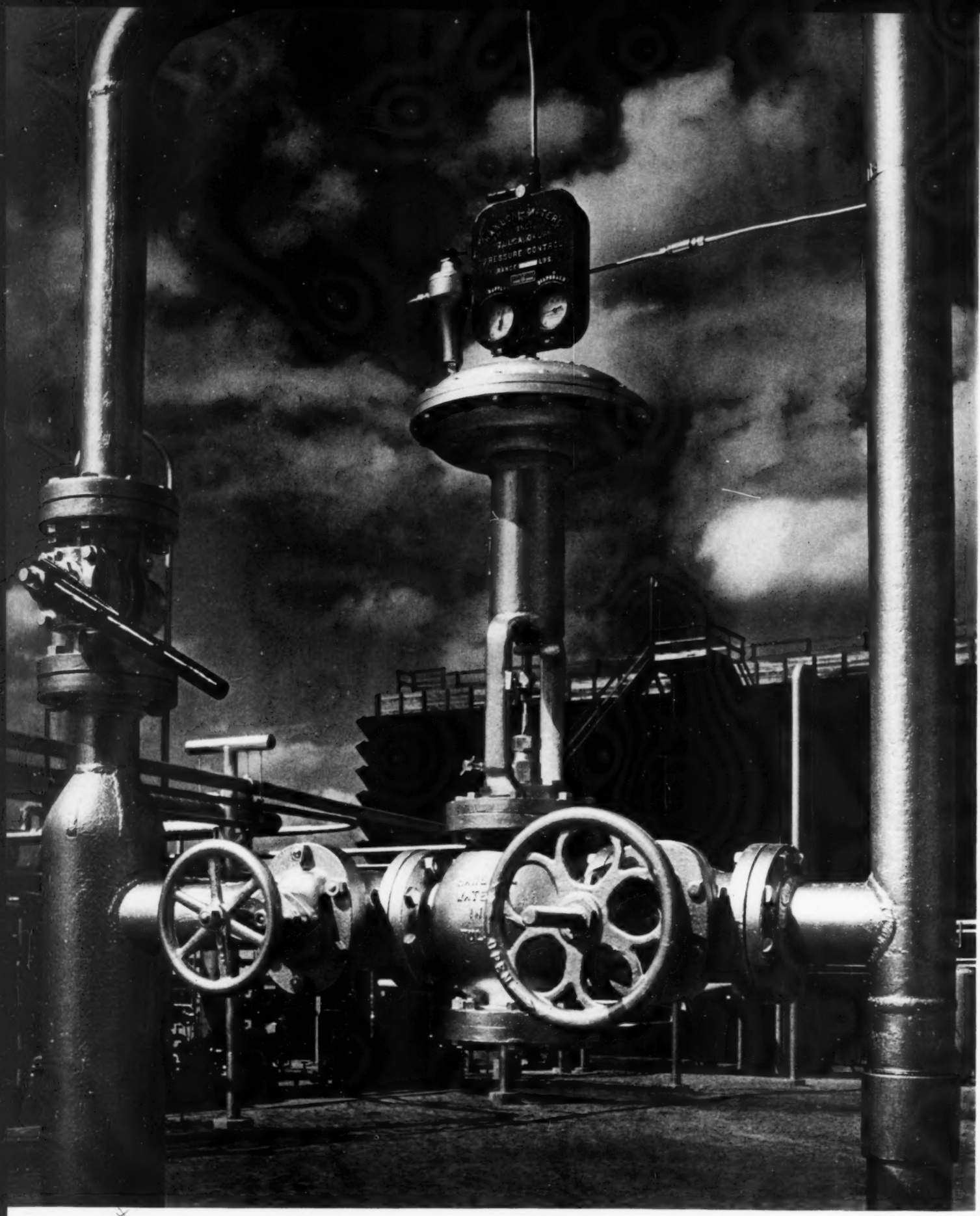
The Publisher does not necessarily endorse the views expressed by authors of signed articles. In the service of readers he will not hesitate to give publication to signed opinions in direct opposition to his own.

Advertising rates obtainable on request.

▼

COPYRIGHT

COPYRIGHT, 1941, by Russell Palmer estate. Contents may not be reproduced without permission.



1940: Notable increase in emphasis on pressure maintenance operations

EDITORIAL

OIL INDUSTRY'S OUTLOOK FOR 1941

DURING 1940 the petroleum industry of the United States continued the steady expansion which has come to be expected as a regular development, under normal conditions. In view of the disruption of export trade which ordinarily contributes an important part of the demand for American oil the year just closed could hardly be called a normal period. Some of the country's most important markets were shut off completely while others were able to take only a small proportion of their customary purchases. Shipments to outside markets fell off 55,000,000 barrels or nearly 30 percent as compared with the year preceding and were less than in any previous year since 1936.

In spite of the serious loss in exports, however, the industry has maintained a substantial rate of growth. Scientific surveys and wildcatting have brought in new fields and raised the volume of reserves. Drilling increased nine percent and the number of new wells brought in was greater than in any previous year except 1937. Crude production was seven percent greater than in 1939 and substantial additions were made to refining and storage capacity. Stocks of crude and motor fuel have grown larger during the year though this is scarcely to be cited as an example of progress in view of their more than ample proportions a year ago.

Domestic demand for gasoline rose six percent or roundly 35,000,000 barrels during 1940. As a consequence of this substantial growth total demand gained 2.5 percent notwithstanding the decline of 40 percent in gasoline exports. Even more noteworthy was the growth in demand for distillate fuel oil of over 25,000,000 barrels or 11 percent. Residual fuel oil sales increased roundly five percent while the sales of lubricants advanced sharply under the impetus of enlarged demand, both domestic and export.

Looking forward to 1941 the prospect appears to favor a further increase in the oil industry's scale of operations due to an expanding demand for its principal products. Certain factors in the industrial situation indicate that the gain in some of these products will be greater than was shown in 1940 as compared with the year preceding. The most effective of these influences in all probability will be the nation wide defense program with its far reaching demands for the employment of more mechanical and man power, its stimulus to transportation and its output of machines requiring gasoline, fuel oil and lubricants for their operation. The production and use of such defense equipment should attain a greatly increased volume during the second half of the year.

Estimates of motor fuel consumption for the coming year agree that a rise of six to seven percent in domestic demand is a conservative forecast. Some further decline in exports is considered probable but a consensus of marketing experts places the probable total demand for gasoline at 645,000,000 barrels, which would be a gain of approximately five percent over 1940.

Expansion in the demand for distillate oil fuel has been very rapid and has amounted to 80 percent during the past five years, keeping pace very closely with the growth in number of oil burning installations during the same period. Since so large a proportion of the total consumption of light fuel oil is for domestic heating the demand varies according to the severity of the winter season. On the assumption that the extremely low temperatures experienced in many parts of the country during the early months of 1940 will not be repeated some statisticians look for a smaller rate of expansion than took place last year; possibly a gain of five to six percent. On the other hand a greater increase in the demand for residual fuel oil which is used largely by heavy industry is anticipated and the rise in consumption of lubricating oil and grease is expected to continue at a rate as high or higher than was shown in 1940.

Whether the oil industry will benefit by higher earnings from an expanding volume of business remains to be determined. Motor fuel is the chief money crop of the oil industry and gasoline prices in 1940 were lower on the average than in any year since 1933 while the spread between crude and gasoline prices

was less even than in that disastrous year. If unwarrantedly high production and excessive runs to stills are avoided during the winter months; if a conservative course is followed by expanding output only as demand calls for such action, the record of 1941 should be reasonably satisfactory from the business point of view.

There exists no real obstacle to the adoption of such a course. Last year an extraordinary demand for distillate fuel oil due to prolonged cold weather over a great part of the country led to the accumulation of record breaking stocks of gasoline in order to meet the need for heating oils. Since then a readjustment of the gasoline-heating oil ratio on the part of many refiners has led to the establishment of more adequate fuel oil stocks at the commencement of the season of heavy consumption. The ability of the industry to meet any additional demand that may be put upon it is attested by its ample reserves of productive power and refining capacity. Fundamentally the outlook for the industry is not unfavorable, but the extent to which advantage will be taken of its opportunities depends largely upon the industry itself.

ICKES'S TROJAN HORSE IS SPAVINED

WITH the concentration of public attention upon the task of national defense, it was perhaps inevitable that the advocates of all sorts of extraneous causes should endeavor to attach their pet projects and ideas to the cause. Every ambitious town sees itself as the ideal site for a munitions plant or an airfield. Every creek aspires to be the location of a busy shipyard. Similarly those who seek to change either the traditional form or substance of American government or to revolutionize the industrial organization of the country try to link their ambitious plans to the demand for national preparedness.

Under these conditions it was a foregone conclusion that Secretary of the Interior Ickes would be one of the first in the field among those whose recipe for improving the operation of American industry is to take it apart and reconstruct it at this critical juncture.

The surge of public sentiment to support every measure capable of aiding the national defense offered a chance of which the advocates of federal control were not slow to take advantage. At once they raised the cry that national protection required that the federal government take over the oil industry from "well to service station" to use the secretary's own words. The attempt to stampede the National Defense Council and the members of the special Congressional committee which has been conducting a long range investigation of all phases of oil industry operations into precipitate action to this end has met with no success thus far but the former Oil Administrator is a persistent man and can be counted upon to continue his efforts at every opportunity.

The irony of the situation is that among all the industries of the United States there is none which is better prepared to meet every demand that a national emergency may put upon it and therefore none less in need of governmental interference than the American oil industry. This fact has been publicly acknowledged not only by members of the Defense Council but by officers of the Army and Navy. If more production is wanted the industry can supply it on twenty-four hours notice. If additional refinery capacity needs to be put to work the capacity exists for this purpose. Increased storage and enlarged transport facilities already are being provided. The oil companies have stepped up their production of aviation gasoline beyond current commercial requirements and are only awaiting instructions from Washington authorities to know how much further they are to go in this direction.

At its recent convention in Chicago the oil industry adopted resolutions placing it unreservedly at the service of the nation to meet any and all requirements in the way of petroleum products. It has established a national committee to cooperate with defense authorities and has set up regional committees to guard against sabotage. To the last man it is prepared to go down the line to play its full part in carrying out any plans that may be adopted to add to national security or to aid those who are fighting the battle of democracy.

Back of its present preparedness to serve the oil industry is the remarkable record of efficiency established in the world war of twenty-five years ago. Stepping into the breach at the moment when lack of oil threatened the allied cause with disaster the industry, through its own efforts and its own organization, met every call made upon it promptly and efficiently and without involving the government in any of the expensive long term commitments which in some other fields of activity added so greatly to the cost of that conflict.

The utter folly of disrupting the organization of the oil industry, especially at an hour when all energies should be concentrated on a vast work of preparation in the shortest possible time, is evident to every practical man. The choice of a time of national emergency to attempt to hamper and hamstring the work of such an industry by placing upon it the shackles of unneeded federal control is one that only the mind of an Ickes could conceive.

Oil Industry Faces Renewed Drive for FEDERAL CONTROL

President's Letter Urging Legislation Brings Added Lease on Life to Cole Committee—Hearings to Deal with Industry's Relation to Plans for National Defense.

FURTHER Congressional investigation and continued pressure by administration forces to extend federal control over its management and operation confront the oil industry as part of its portion during 1941. This was made certain by the action of the special sub-committee of the House Interstate Commerce Committee in requesting an extension of life from the Seventy-seventh Congress on the first day of the new session, a request that was promptly granted. At the same time the sub-committee made public the letter written by President Roosevelt to its Chairman Representative W. P. Cole, several weeks ago in which he endorsed the demand for legislation to establish and maintain sound economic conditions in the oil industry.

1940: ***Increasing attention to light portable rigs, such as the one illustrated operating in Calcasieu Parish, La.***

© Lionel Green

1940: ***Decreasing shipments from the United States marked the year. In large areas civilian consumption was curtailed drastically.***

Except for the demand of Secretary Ickes for additional hearings and the intervention of the President the committee would have concluded its activities and prepared its report before the end of 1940.

Despite the recent report of the National Defense Advisory Commission holding the existing structure of the petroleum industry well adapted to defense needs the committee has been induced by this pressure to continue its investigations as to whether federal control legislation is needed to safeguard the national petroleum supply and prevent waste.

Undoubtedly the chief factor in this decision was the letter addressed to Representative Cole by the President under date of November 29, which added another to the series of communications he has issued since the Cole bill was introduced early in 1939. This time the national defense was used as the prime reason for immediate government supervision of oil production, at least to the extent of formulating "standards" and providing for their enforcement in states lacking specific regulatory statutes of their own.

"The vital need for petroleum in the national defense, the importance in commerce and industry, and the critical conditions in Europe and Asia," wrote the President, "confirm my belief in the urgent need of

federal legislation to safeguard our petroleum supply through the prevention of waste and by the establishment and maintenance of sound economic conditions in the oil industry."

The President said he hoped the committee would be able to make "appropriate recommendations" in the near future, based perhaps on "the different approach" to the problem of federal control he had suggested in a previous letter to the committee, issued last March, after the governors of nine states had opposed the Cole bill sponsored by Secretary Ickes.

In this previous letter, the President, after noting that the major objection to the Cole bill "seems to be that its provides for federal enforcement of these standards in all fields regardless of the adequacy of state enforcement", suggested:

"I should think it would be possible to agree that the standards of production necessary to qualify oil for shipment in interstate commerce should be enforced by the federal government only if an authorized federal agency finds that the states have failed to enact laws requiring conformity with federally-prescribed standards or have failed persistently to enforce compliance with such standards when required by state laws.

"In so far as the states fail to enact or enforce oil and gas conservation laws requiring conformity with the standards prescribed by federal law, I should think that oil producers should be given the right to qualify their oil for shipment in interstate commerce by entering voluntary agreements, subject to the approval of the authorized federal agency, to conform with such standards. Legislation along these lines would, in effect, be an extension of the principles of the Connally act."

As a result of the President's latest letter to the Cole committee on the eve of the new Congress, members decided to forego filing the report called for by the resolution under which it has operated and to apprise the House of its intention to continue the investigation on "the question of petroleum in the national defense". In support of continuance of the committee for which House approval was given, it was argued that of the original $15,000 appropriated for the petroleum investigation "approximately one-half of that sum remains so that the additional work of the committee will not cost anything."

As Representative Cole contemplates exhaustive testimony from defense experts including William S. Knudsen, director of the newly-created Office of Production Management, Edward S. Stettinius, Jr., head of the materials division of the National Defense Advisory Commission and Dr. Robert E. Wilson, head of the petroleum section of N. D. A. C., it is not unlikely that the government's pending anti-trust suit against twenty-two oil companies and its effect on the industry as a national defense implement will figure in the inquiry.

Although the suit as instituted is limited to charges of price-fixing and discrimination and was shorn of the original proposal of the Department of Justice to force divorcement of marketing and transportation facilities from production at the insistence of the Defense Commission, Attorney General Robert H. Jackson, announced at the time that he was not abandoning this phase of the attack. He simply said that the anti-trust division "at this time" does not seek to compel the companies to get rid of their transportation and marketing functions.

Nor can the Cole committee, even in consideration of legislation on the basis of the "new approach" to federal regulation suggested by the President, fail to note the findings of the Defense Commission in its report on the anti-trust action as follows:

"A development widely endorsed by federal and state conservation authorities has been the organization of newly-developed oilfields on a unit basis. The proposed suit apparently prohibits such activities, many of which are now carried on under the supervision of the Department of the Interior. These unit plans are deemed a major force in conservation since they reduce the number of wells to be drilled, conserve gas or hydrostatic pressure and otherwise conduce toward scientific production. This, of course, means lower investment costs and insures lower production costs and higher ultimate recovery of oil."

In any event the Cole bill of the last Congress, which was sponsored by Secretary Ickes, will be revised in major details before it is reported by the sub-committee or the full Interstate Commerce committee of the House if the defense testimony follows the lines of previous statements in its presentation of the industry's preparedness to cooperate in the national defense effort. Before the cooperation can be properly affected, the industry apparently will have to have assurance that it will not be prosecuted under the anti-trust laws and be penalized as it was in the Madison trials for cooperating with a government agency.

The hearings also may be expected to disclose how the anti-trust proceedings and the proposals for federal control, no matter how limited, have delayed the immediate defense effort.

While aviation gasoline and lubricating oils have been subjected to export licensing control since last July and the license recently was extended to "equipment and plans for the production of aviation lubricating oil", the Army and Navy have failed to go ahead with the comprehensive recommendations made six months ago by the National Defense Advisory Commission by which the government would purchase and store enough special motor fuel for a 100-day, or "war" effort by all the aircraft the military establishment may have acquired in the next 18 months.

Divided authority, legal difficulties and lack of clear-cut authorizations for funds also have combined to prevent a start in the construction of the storage facilities for the proposed supply to be provided by the Army and Navy. Neither has the government moved, through the Defense Supplies Corporation, to arrange with the refiners for development of the additional storage. Instead of suggesting additional refining capacity at this time the Defense Commission had recommended that it would be reasonably safe to let capacity for 100-octane gas remain at about 50 percent of war demand and use available funds for building up reserve storage.

Still in the planning stage is the further suggestion of the Defense Commission for construction of a 12-inch pipe line from the mid-continent to the eastern seaboard to put aviation gasoline directly into army and navy bases in the event of the crippling of tanker or other transport facilities.

Meanwhile the consumers division of the Defense Commission in charge of Miss Harriet Elliott has come forward with a criticism of rise in price of heating oil as having taken place, only because of an "increased demand for fuel oil for home, office and apartment heating which furnished the opportunity to producers and distributors to obtain higher prices."

The commission statement asserted that the shortage of tankers from Gulf to New England ports did not explain the rise in prices since tanker and storage facilities were adequate to take care of the existing demand and operating costs of tankers, have not risen except in wages which are "not more than 15 percent of the total cost of tanker operations."

"Tanker tonnage transferred to the Navy and to foreign registry," said the statement, "represents only about 13 percent of the total tanker capacity. Published charter rates for tankers have increased, but 90 percent of the oil moving from Gulf ports to the Atlantic seaboard is transported by tankers belonging to large oil companies which do not pay charter rates. Apparently there has been no important increase in the cost of operating these tankers.

"The Consumers' Division is continuing its study of the present fuel oil situation with the view of suggesting action to the Defense Commission, to the producers and distributors and to consumers of fuel oil. Conferences may be held later with representatives of the industry." Price increases along the Atlantic seaboard were listed by the consumer's division as follows:

> The retail price per 100 gallons of Number 2 fuel oil increased in Boston this year from $6.13 on September 15 to $7.00 on December 15; in New York from $6.12 to $6.89; in Philadelphia from $6.33 to $6.75 and in Baltimore from $6.00 to $6.75. The September 15, 1939, December 15, 1939 and March 15, 1940 retail prices were: in Boston—$6.18, $6.75 and $7.05; in New York—$6.38, $6.69, and $7.14; in Philadelphia—$6.00, $6.40 and $6.98; and in Baltimore—$6.25, $6.83 and $7.00. Tanker rates from the Gulf to North Atlantic ports rose from 21 cents a barrel in August to 80 cents in December, as compared with a rise from 16 cents to 60 cents during these same months in 1939. Gulf prices for No. 2 oil fell from $4.00 per hundred gallons in December 1939 to $3.25 in September 1940. There have been no further decreases since then.

No doubt the usual crop of bills introduced at each new session of Congress, designed to

disintegrate oil companies or to affect the operations of the industry in various ways, will make their appearance as the legislative machine gets under way. From present indications, however, the most serious threat to the industry lies in the determined effort of Secretary Ickes and his group to force through some measure of direct federal control. While the President has given this movement his approbation its chances of success may depend ultimately upon how far he is willing to go in putting the full force of administration influence behind it. Left to itself Congress would show very few votes in favor of disturbing the smoothly functioning machinery of the oil industry at a time when its effective operation is a most important factor in national defense.

Consumer Demand Expected to Rise Eight to Ten Percent in 1941

Statisticians in Washington Look for Marked Upturn After First Quarter With Moderate Advance in Gasoline Consumption, Sharp Gain in Residual Fuel Oil, Increase in Imports and Further Decline in Exports.

Courtesy Geochemical Exploration Co. by Robert Yarnall Richie

FURTHER substantial increase in domestic demand for petroleum products is the prospect which statisticians and trade observers see for 1941 in the United States. Yet in making these forecasts they one and all point out the uncertainties confronting an industry geared to war economy and emphasize the danger in attempting to discount the expected gain by pushing up production too rapidly. "Meet the rise in demand as it develops" they say, pointing out that the increased industrial activity which is expected to result from the national defense program will not be running at full tide before the middle of the year and that with motor fuel stocks steadily rising in the seasonal movement usual at this time it would be a serious mistake to boost production prematurely.

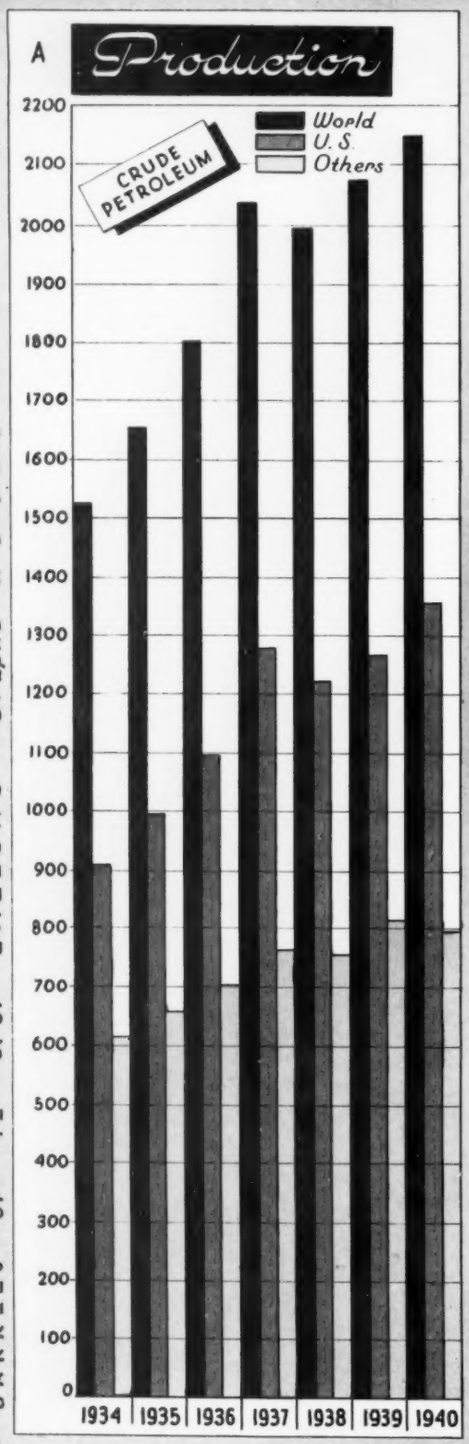
In Washington where a rise of 8 to 10 percent in domestic demand for principal petroleum products is looked for the Bureau of Mines considers a crude production of 3,591,000 bbl. daily adequate to cover all needs during January 1941. This is virtually the same as actual requirements in January 1940. In putting out its estimate for the current month the Bureau departed from its usual custom to the extent of appending a discussion of the general situation similar to that presented before the recent meeting of the Interstate Compact Commission by A. G. White, Chief of the Petroleum Economics division of the Bureau. This statement in part was as follows:

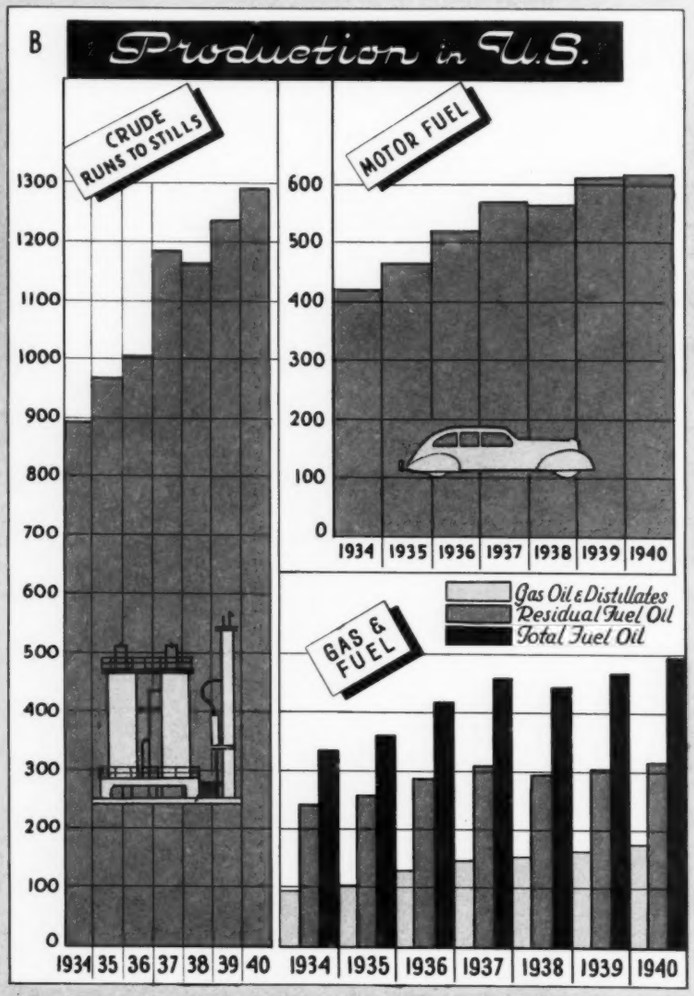
"It is necessary to consider the probable

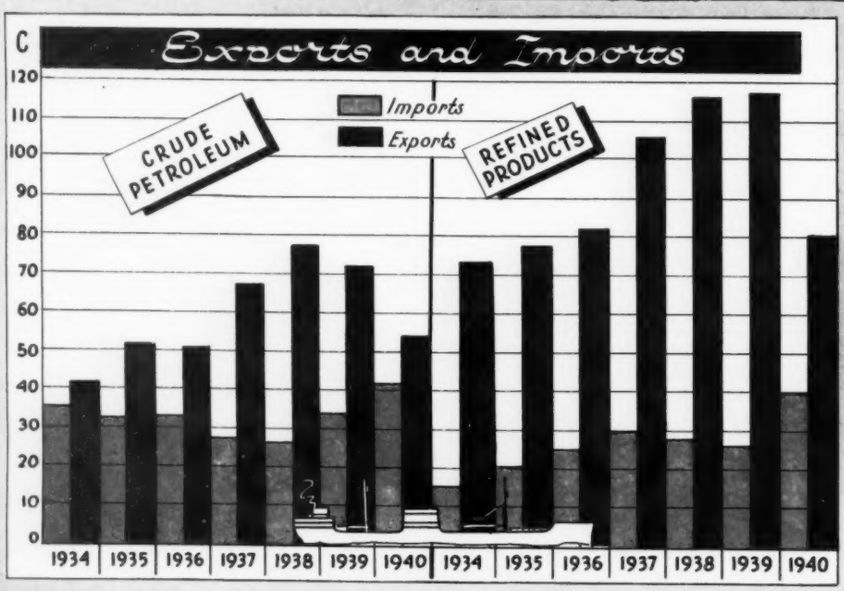
Record of OIL INDUSTRY 1934-1940

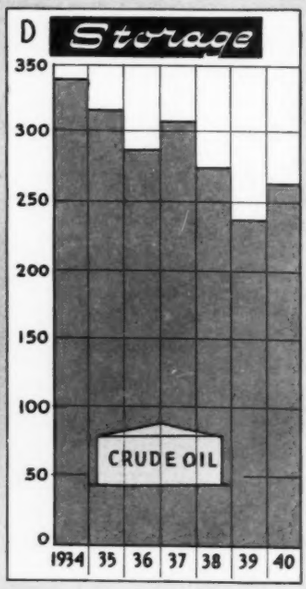
Based on Year-end Statement by AXTELL J BYLES

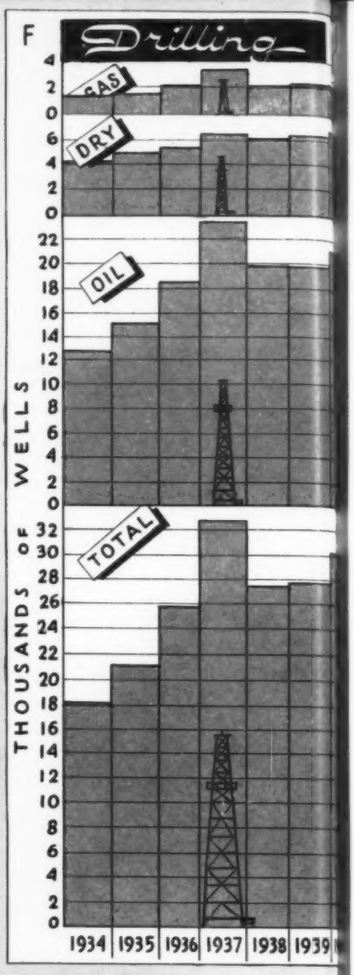
Pres American Petroleum Institute

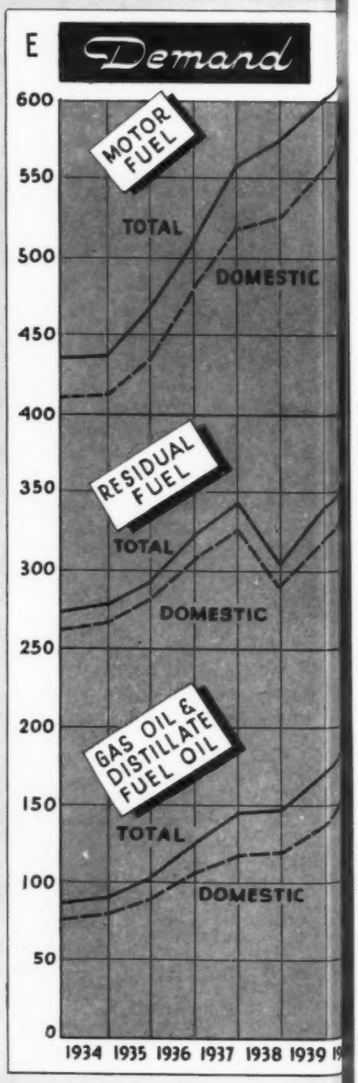












MILLIONS OF BARRELS OF U.S. GALLONS :: Graphs A·B·C·D·E

demand for all oils during the coming year to secure the proper perspective for a reasonable forecast of operations for the first quarter of 1941.

"An increase of 8 percent in the daily average domestic demand for all oils in 1941, including special defense requirements and stocks, seems a reasonable and conservative assumption, assuming no drastic changes in international relations. This would amount to an actual increase of about 102 million barrels for the year. A further loss in exports might reduce this figure to a 6 percent increase in the total demand for all oils, a gain of about 87 million barrels in 1941 over 1940.

"Crude production of about 3,700,000 barrels daily in 1940 will be in excess of demand as indicated by an estimated increase in the stocks of all oils (crude and refined) of about 40 million barrels for the year. Consequently, the same rate of production in 1941, with no stock changes, would supply almost one-half of the increased demand for all oils (87 million) as estimated above. The remaining increase of 47 million barrels in the demand for all oils might be met by stock decreases of 10 million, by increased imports of 10 million, and by a gain in crude-oil production of 27 million barrels. This would indicate a daily average crude-oil production of 3,775,000 barrels in 1941, an increase of 2 percent over 1940.

"The balance of possible refined oil exports, imports, and stock changes would indicate an increase in crude runs to stills of over 4 percent—or an average rate of nearly 3,700,000 barrels daily for 1941.

"If demand should exceed these estimates materially, a direct increase in both crude production and runs would result, and refinery operations east of California might be close to capacity, particularly if crude runs in the first quarter are at too low a level.

"The abnormally high demand in the first quarter of 1940 will reduce the rate of increase in demand for the same period in 1941 below the estimated average for the year but the relative increase in subsequent quarters would be progressively greater.

"The Bureau belives that its forecast of crude runs and demand for January represents a minimum, and that these figures may have to be increased in subsequent forecasts for February and March if the trend of demand proves greater than now seems reasonably probable.

"The current adjustment of unbalanced refined inventories would indicate the continuance of the yield trends as shown in actual October operations, namely, a relatively low gasoline yield, a normal distillate yield, and an increased residual yield.

"A sharp rise in the demand for residual-fuel oils is indicated as defense activities get into full production. Residual-fuel stocks east of California, although several million barrels above the abnormally low level of last year, appear to be inadequate. As indicated in the December forecast, this situation would require either greater runs than are necessary for other products, increased residual yields or larger imports.

1940: ***Saw the Tulsa Exposition in full swing with hundreds of foreign visitors studying recent developments despite the war on two continents.***

"Stocks of finished and unfinished gasoline apparently will be about 82 million barrels on December 31, 1940. A normal increase of at least 14 million barrels seems unavoidable in the first quarter of 1941, so that a peak of 96 million barrels is probable on March 31, 1941, as compared with almost 104 million barrels at that same time in 1940. This stock position would represent a material improvement because of an expected increase of 6 to 7 percent in domestic motor fuel demand during 1941 and also because the figure will include an increase of several million barrels in essential aviation-gasoline stocks."

Of particular interest to the industry generally is the forecast for a sharp rise in the demand for residual fuel oil east of California and the suggestion that it may be advisable to meet this demand by imports rather than to convert a larger percentage of high grade domestic crude to this type of fuel. Prospects are, as stated, for an increase in imports of from 5,000,000 to 10,000,000 barrels of heavy fuel oil in 1941 over those of 1940.

The question is whether the domestic industry wants to step up its production of such oils at the expense of throwing supplies of gasoline out of balance or to look to foreign fields for the necessary supplies. Officials see the situation duplicating that of 1939 when a lack of balance in the last quarter between refinery production and yields of gasoline and distillate fuel oils on the one hand and demand on the other resulted in a sharp increase in gasoline inventories. In the present case the problem is with residual fuel oils.

Production of residual fuel oils was stepped up in the first ten months of 1940 to 413,791,000 bbl. compared with 386,468,000 barrels for the same period in 1939 while imports in bond and for domestic use jumped to 25,496,000 bbl. from a figure of 13,998,000 in 1939. Exports at the same time dropped to 13,830,000 bbl. from 15,049,000 for the first ten months of 1939, while refinery stock decreased to 94,658,000 bbl. from 99,921,000 barrels and bulk terminal stocks increased to 6,804,000 barrels from 5,464,000 barrels.

Daily runs of crude oil to stills, it is pointed out, would have to be reduced below the 3,600,000 to 3,700,000 barrels envisioned, if stocks of gasoline are not to be thrown out of balance.

Heavy fuel oils can either be imported or shipped to the east from California, but high transportation cost would appear to make the latter less feasible than bringing larger quantities from South America. Against imports of 59,000,000 barrels in 1939 and 84,000,000 barrels (estimated) in 1940 the forecast for 1941 in Washington is approximately 94,000,000 barrels.

It also is expected that exports of motor fuel aggregating 45,000,000 bbl. in 1939 and

25,000,000 bbl. in 1940 (estimated) will drop to 10,000,000 or 12,000,000 bbl. in 1941.

Although the military requirements, based on estimates of the Army and Navy, are expected to increase the demand it is further pointed out that such estimates almost invariably are put at maximum and seldom materialize in the period for which they are made.

Special requirements for 100 octane aviation gasoline will depend upon the requirements of the Army and Navy since there is small commercial demand for this product at present. If the plan for government purchase and storage of an emergency supply of this fuel is carried through some millions of barrels will be required for this purpose and as the production of planes expands more high test fuel will be needed of course for their operation.

Present stocks of aviation fuel are estimated at approximately 4,000,000 bbl. Productive capacity is being increased and according to a statement by W. S. Farish, president of Standard Oil Co. (New Jersey) will permit a daily output of 35,000 bbl. by March next. Mr. Farish, who is chairman of the special committee appointed by the American Petroleum Institute to cooperate in meeting the oil needs of the national defense program has suggested in a letter to leading refiners that present output of 100 octane gasoline could be double in twelve to fourteen months time by the expenditure of $30,000,000 on additional refining facilities. Action in this direction will be governed however by the demands of the Army and Navy.

In attempting to arrive at the probable demand for petroleum products in 1941 by averaging the estimates of trade authorities one can place the figure for motor fuel tentatively at 645,000,000 bbl. as compared with 616,000,000 in 1940; for distillate fuel oil at 205,000,000 bbl. against 184,000,000 in 1940; for residual fuel oil at 425,000,000 in comparison with 358,000,000 in the year just ended; and for crude oil production on the order of 1,400,000,000 bbl. instead of the 1,355,000,000 produced in 1940. All of these calculations of course are subject to alteration by changes in the war situation.

German Occupation of Roumania Due to Oil Needs of Prolonged War

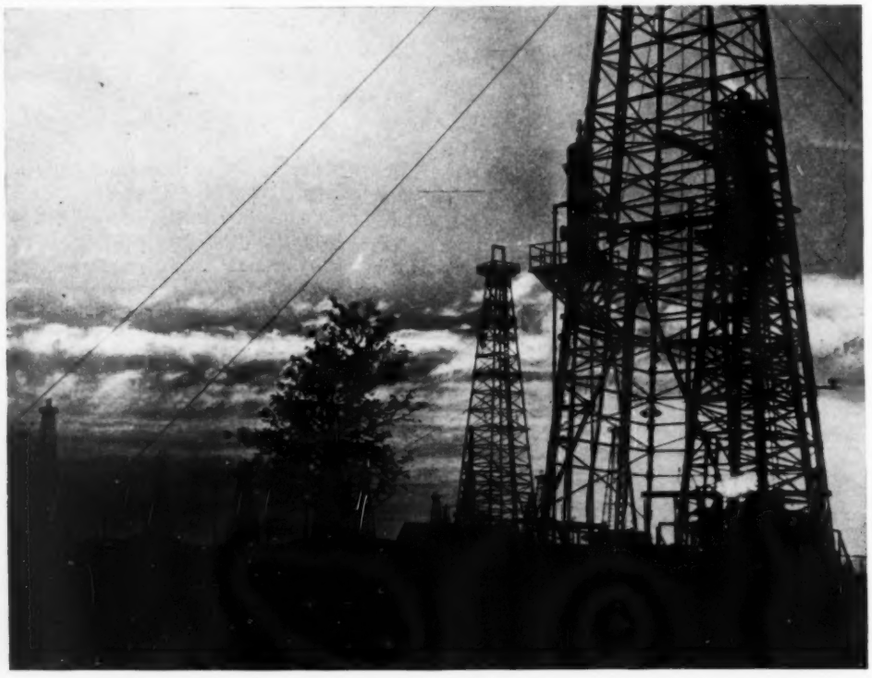
New Pipe Lines and Railway Facilities Being Constructed to Help Solve Difficult Problem of Transportation-Shipments to Other Countries Cut Off.

ASSERTION that Germany's recent move into Roumania was undertaken reluctantly is likely to meet with disbelief in many quarters. The general interpretation is that the extension of German authority over the Danubian state was the initial step in a settled plan to dominate the whole Balkan area preparatory to a drive into western Asia.

Accomplishment of the long cherished *drang nach osten* unquestionably has its place in the ambitious schemes of the Nazi leadership. But among those who are best informed as to the reasons for German moves on the European checkerboard the opinion prevails that the Fuehrer's hand in this instance was forced by the failure of events in the western war arena to move according to the time table that had been set up.

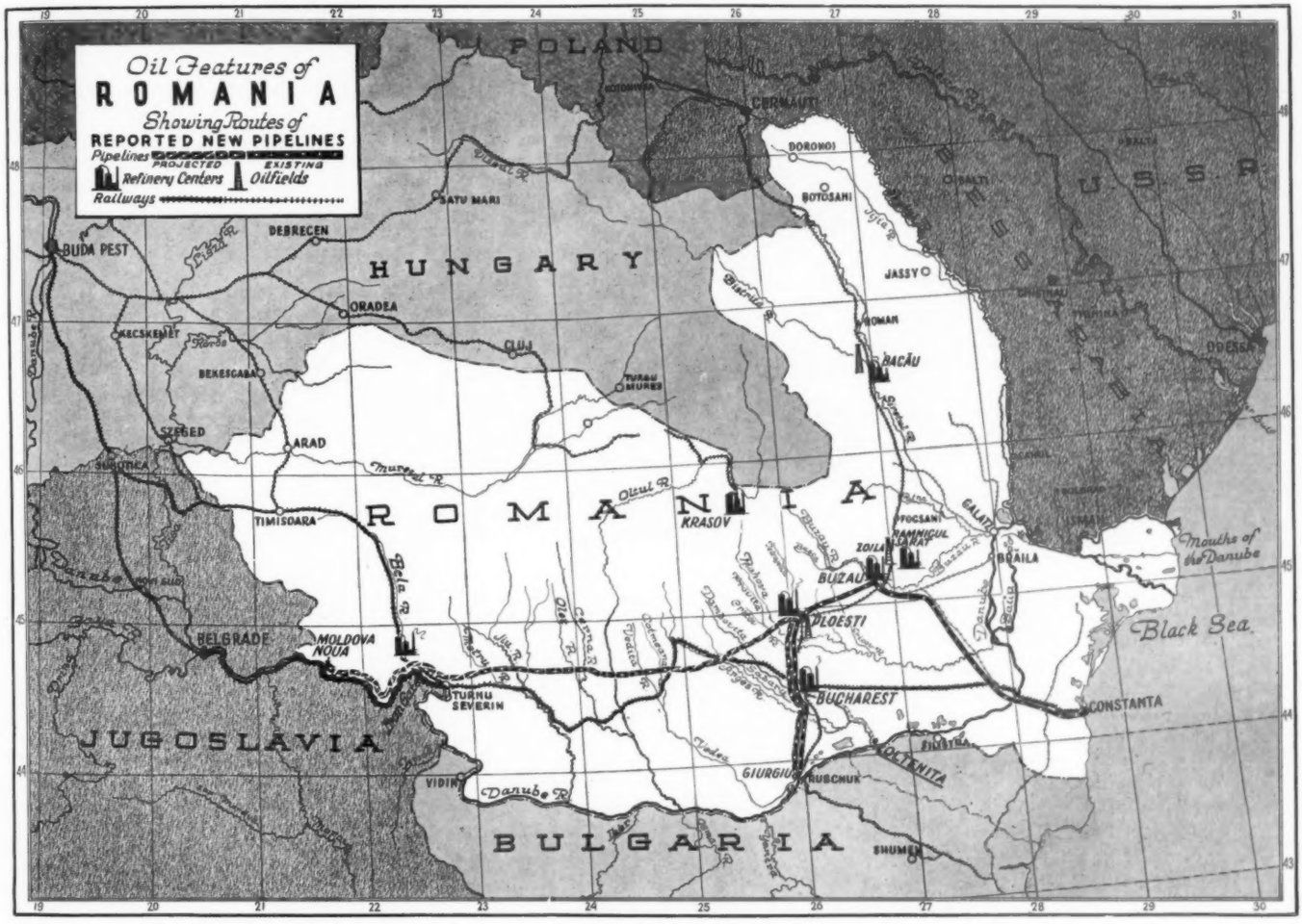
Sunset in the Roumanian oilfields now occupied by the German army intent on increasing production for a prolonged military effort.

© British Combine



The German plan of campaign called for the swift suppression of French and British resistance. Until this was accomplished Nazi strategy dictated an avoidance of war in southeastern Europe at all costs. Open interference in Roumania involved a serious risk of spreading the conflict to the whole Balkan area. The risk had to be taken finally because the stiff resistance of the British and the unexpected air offensive which they put on forced a revision of measures for meeting the situation. With the possibility that the struggle might continue for two, three or five years Germany needed a more dependable supply of petroleum products. A country rent with the disorders that preceded and followed King Carol's abdication could not be relied upon for such a constant supply. Direct control and supervision of Roumanian industry became a matter of necessity in German eyes. Prolongation of the war, together with Britain's growing power of aggression, demanded more oil. This demand, more than any other one factor, spelled Roumania's fate and brought her to her present position of complete subservience to the Reich. Likewise it explains the timing and the manner of the Nazi thrust to the Danube and the Black Sea.

How great Germany's need of oil from outside her own boundaries may have become and how far the output of Roumanian wells and refineries can go toward supplying these requirements only time will tell. Undoubtedly Germany entered the war with large stocks of the petroleum products most needed for military operations. Undoubtedly too the drain upon these stocks during the first year of war was less than anticipated. Supplies acquired through the invasion of Poland, Denmark, Norway, the Low Countries and



France may have been large in the aggregate despite the efforts made in some of these countries to destroy oil held in storage in face of the invader's advance. In addition to stocks on hand and those acquired by capture a considerable extension of Germany's synthetic production probably has taken place.

At the beginning of the struggle there were numerous predictions that Germany's war efforts would be seriously handicapped by lack of oil. These forecasts were based upon the expectation that the conflict would follow more or less closely the pattern of the first world war. Actually it has assumed a character entirely different and one that has involved a consumption of motor fuel and lubricants much smaller than was expected. It hardly can be doubted that persistent British bombing of German oil refineries, synthetic plants and storage depots has inflicted extensive damage and losses but precise information on this point has not been allowed to reach the outside world. During the past fifteen months, however, there has been no indication of a serious shortage in German oil and at the present time there is no convincing evidence of difficulty in finding the limited quantities needed for the maintenance of air raids and submarine forays which have been the principal forms of military activity in recent months.

When all this has been said, however, it remains true that Germany's internal resources are insufficient to meet the petroleum requirements of a long war, particularly if the contest should extend to new areas requiring land and air operations on a much more extensive scale than has been the case heretofore. Of such a spread there is constant danger and the resources of German influence and diplomacy have been constantly at work to avert it.

Looking over the oil map of Europe it is easy to understand why German authorities faced with the possibility of a long drawn out struggle should have decided that it was necessary to get full control of whatever amount of oil Roumania could produce. European oil production, outside the Soviet Union, in the year preceding the war was roundly as follows:

Country	Tons
Roumania	6,600,000
Poland	550,000
Germany—Old Reich	550,000
Germany—Austria	60,000
Germany (former Czechoslovakia)	20,000
France	70,000
Italy	15,000
Italy-Albania	65,000
Hungary	40,000
	7,920,000

All Europe west of Russia produced less than 8,000,000 metric tons annually. This is less than 60,000,000 bbl., less than an average three weeks output of the wells in the United States and only about 10 percent of Europe's normal needs, again excluding Russia. Roumania was the only important exporter in the list. Poland shipped small amounts to nearby countries but since its partition the larger part of the Polish fields has reverted to Soviet control. Albania's oil went to swell Italy's negligible output but none of the other countries named could provide more than a fractional part of its own yearly requirements.

The successive steps by which Germany has advanced to full control in Roumania have been related in day to day news reports. To well informed observers it has been clear that the objective has been primarily economic and only incidentally political. The task was not only to get control of Roumania oil but more particularly to find means of putting more of that oil into Germany and to do this if possible without spreading the war to the Balkans.

The first part of the task has been accomplished. Germany has control of the Roumanian oil industry and can say what part of the production, if any, shall be permitted to go to other countries. Since September such shipments have fallen to a fraction of what they were before the war. At the same time

Roumanian production has declined. During October it averaged only a little over 100,000 bbl. daily or at the rate of about 5,000,000 tons per year.

To some extent the earthquake which centered in the oil producing area undoubtedly was responsible for a temporary decrease in output. No comprehensive reports as to the exact extent of the damage resulting from this cause have been made public but apparently it was much less severe than was indicated by press reports published at the time.

So far as injury to refining plants and to the wells is concerned such information as has come from private advices indicates that this has been repaired to a great extent under pressure from the Nazi authorities and under the direction of their technical experts. Now German troops guard the oilfields and German officials direct the operations of refineries. An attempt is being made to step up production. But the second half of the program remains to be carried out and that may prove the more difficult part of the undertaking. It involves increasing the shipment of oil to Germany in quantity sufficient to meet that country's needs.

At the beginning of the war a trade agreement was signed between Roumania and Germany under which the latter was to receive 130,000 tons of oil monthly. This would have amounted to 1,560,000 tons, nearly 11,000,000 bbl., in the course of a year, if the full amount had been delivered. Actual deliveries up to June last averaged less than 85,000 tons monthly. In July the movement nearly doubled but since then has declined again. Lack of transportation was the principal reason for failure to deliver a larger amount. With the closing of the Black Sea-Mediterannean route there is but one main artery for freight traffic from Roumania to Germany. That is the Danube which from the earliest times has been a great trade highway from southeastern Europe to the west. By dredging and the contruction of canals the river has been made navigable all the way from the Black Sea to the western part of Germany for shallow draft barges and tugs.

But there are limitations on the capacity of this waterway. The most serious is that it is frozen up for four to five months of the year. During the open season there are bottlenecks at various points that restrict the movement of traffic. One of these is the famous Iron Gates where the river breaks through the Transylvanian Alps shortly after it passes the western border of Roumania. In the gorges through which the river passes in its course through the mountains, especially for a considerable distance below the Iron Gates, it becomes very narrow at many points with swift currents and sharp turnings which make navigation slow and difficult. Many of the barges are of small capacity and are hauled by slow moving tugs. The river craft are owned by men of various nationalities and during the earlier months of the war British money bought many of them and laid them up to keep them from being used by the Germans.

Two railway lines afford possible outlets for Roumanian oil traveling toward Germany. One of these is the main line connecting Bucharest with Vienna and the cities of western Europe. The other follows a circuitous route northward to Cernauti, and thence through Poland into eastern Germany. The capacity of these rail lines for moving oil is small and is further limited by the scarcity of tank cars and the length of time which they require for the round trip. During the German drive into France in the early summer of 1940 it was reported that oil was being moved by motor trucks from points in Roumania to Germany but this was not officially confirmed. In any case this form of transportation would hardly be used except in an emergency.

Roumania is poorly supplied with pipelines. Aside from gathering lines within the fields and connecting to nearby refineries there are but two of these. The principal one, about 75 miles in length, leads from Ploesti to Giurgiu

on the Danube while a second extends from Buzau to Constanza on the Black Sea. Oil companies have sought permission to build other lines but since the Roumanian railways belong to the government the national policy has been to force the use of railway transport so far as possible for the movement of petroleum products.

In December last it was announced that a contract had been signed calling for the delivery of 3,000,000 tons of oil to Germany during 1941. To make possible the movement of any such quantity it will be necessary to provide much better transportation facilities than have existed heretofore. The way for such action was cleared by a government decree expropriating all pipe lines, storage stations and terminals and providing for taking over all barges and other river crafts. With this as a preliminary numerous other changes are now to be made. These include a 225-mile pipe line from the fields at Ploesti to Moldova Noua on the Danube, just above the Iron Gates. This line is scheduled for completion about April 1 when navigation opens for the coming season. Owing to the poor condition of the roads in this area and the difficulty of moving material during the winter months it is doubtful whether construction can be finished by that date. When completed, however, the line will obviate the necessity of moving all barges through the Iron Gates and will facilitate freight movement by shortening the length of the river journey. Another line 75 miles in length is to extend from the fields to the river port of Giurgiu. Work of double tracking the main railway line for its full length from Ploesti to Bucharest is said also to be underway. A projected pipe line from the Ploesti fields to the Danube has been mentioned in press dispatches but no details regarding this have been made known.

With these changes and with the provision of additional fleets of barges the Germans estimate that they can move 360,000 tons per month during the seven to eight months of open navigation and with smaller amounts moving by rail it might be possible to ship a total of nearly or quite 3,000,000 tons as planned.

Assuming that the full amount of oil provided by the latest agreement can be transported, will this be sufficient to meet Germany's requirements in a protracted war of intensified activity? No positive answer to this question can be given in view of the lack of information as to the amount obtainable from other sources. By an active drilling campaign and by pumping Polish and Austrian wells to the limit it is conceivable that Germany's well production may have been increased to 750,000 tons per year. If the output of synthetic plants, which was about 1,500,000 tons before the war, has been doubled, which seems doubtful, and if the full amount of 3,000,000 tons can be brought in from Roumania this would give a total of 6,750,000 tons which is about 55 percent of the quantity estimated by German authorities as needed in case of war. If the conflict can be confined as at present largely to air and submarine operations such a supply may serve to fill all urgent needs but any extensive damage to refineries and synthetic plants in the Reich such as the British Air Ministry claims to have inflicted through repeated bombings would make the situation difficult even with larger quantities coming in from Roumania.

The long heralded Russian-German trade agreement according to Berlin advices, was expected to lead to a much greater volume of trade between the two countries and to provide for increased supplies of Soviet oil for Germany, but little has been heard alout this of late. Here again transportation is the stumbling block. Russian oil conceivably can move across the Black Sea and up the Danube to Germany but the river's capacity for handling traffic presumably will be fully occupied by Roumanian shipments. It was announced recently that the Dneiper-Bug canal had been opened to service and that a new type of tug with a forward propeller enabled boats to make better time than formerly. This is a circuitous route, however, and it is hardly possible that any large amount of oil can be moved over it. Above all is the question of how much oil the Soviet Union is able and willing to spare for Germany in view of its own greatly increased requirements. With accumulating evidences of increasing tension between the two governments it is safe to say that in all probability the quantity will be small.

Reported movement of large numbers of German troops into Roumania during the latter part of December, with heavy field guns, tanks and other equipment, has aroused renewed speculation as to the possibility of active military operations in the Balkan area. In the event of such a development the large quantities of oil held in storage in Roumania would be most valuable to the Germans and undoubtedly would be reserved for this purpose to the exclusion of all other uses.

One result of the acquisition of full control of Roumanian oil by the Germans has been to intensify the fuel difficulties of other countries which in the past have been more or less dependent on this source of supply. Italy, for example, after its entry into the war had shut off other customary sources of supply through operation of the British blockade, was forced to look to Roumania for oil to feed its refineries and to eke out its meagre domestic and Albanian supplies. For a few months considerable quantities of Roumanian oil were moving to Italy but now this stream appears to be effectively dammed and the acknowledged shortage of fuel is generally accepted as the explanation of the relative inactivity of the Italian air force.

Switzerland also had been obtaining a certain amount of Roumanian oil up to the time when the Germans took over the Roumanian fields but the cost of transportation by the beginning of October had risen to 200 Swiss francs per ton and since then the movement to Switzerland apparently has ceased entirely.

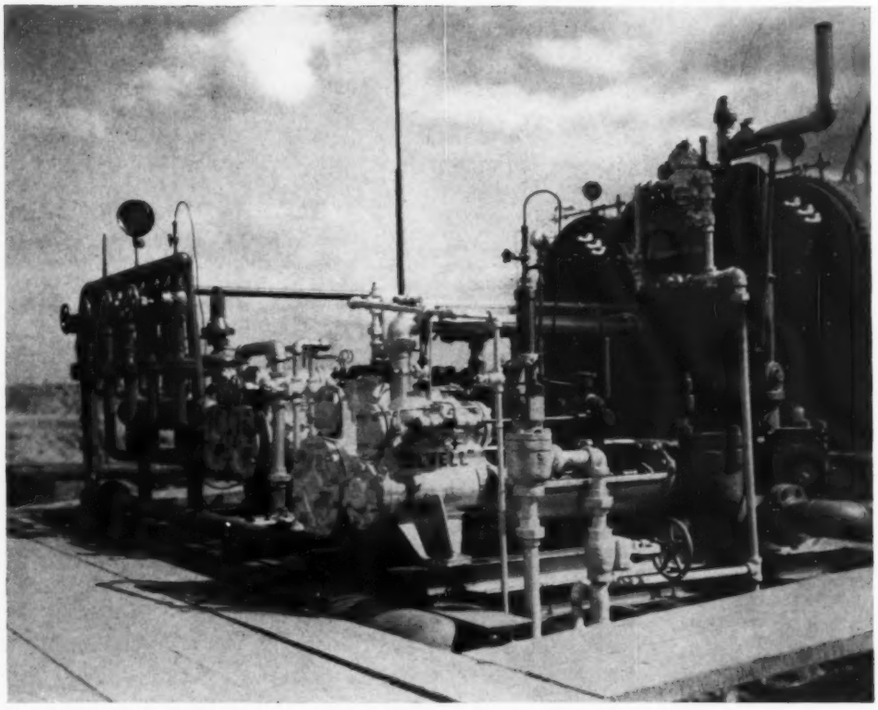
For the immediate future it appears that Roumanian oil will be applied solely to Nazi use, but whether it will suffice to meet Germany's full requirements will depend largely upon the turn taken by the war itself.

DRILLING OUTLOOK FOR 1941

While Not Spectacular, 1940 Saw Substantial Additions to Nation's Reserves — Drilling Activity Should Increase in '41—Time is Ripe for Development of New Exploration Technique.

A NUMBER of factors, chief of which was the lack of any spectacular discovery during the first half of last year, have led to the belief that 1940 was not a particularly successful year as regards new discoveries and additions to the nation's oil reserve. Nor was the outlook for discoveries during the coming year considered too promising. While geophysical methods now in common use have been developed to reasonable point of accuracy, the opinion has been advanced that present methods have already uncovered most of the more obvious prospects; important secondary prospects await more detailed examination, but these, it is thought, will likely yield less impressive results, and the results will be spread over a considerably longer period of time. The record reveals that heretofore, oilfield discoveries have occurred in waves and it has been assumed that the industry is just closing a fruitful cycle of new discoveries and may be expected to enter a period of relative quiet. American Petroleum Institute estimates show that during 1940 some 30,264 wells were drilled of which 21,277 were oil wells. This is the largest number of wells drilled since 1937 and resulted in the largest number of producers since 1937. During 1937 however, 72.2 percent of all wells drilled were oil producers whereas, during the year just past only 69.9 percent of all drilling resulted in commercial producers.

A closer study of the actual drilling results during 1940 indicates however, that the above conclusions are scarcely justified; exploration drilling has, in fact, been exceptionally successful and while nothing spectacular occurred (with the possible exception of the Hawkins field, Wood County, East Texas)



1940: ***Neither Louisiana (above) nor California (right) was the scene of major discoveries, but extension of existing fields added more to reserves in both states than was produced during the year.***

there has been a very substantial addition to reserves. Estimated conservatively, it may be said that 80 to 90 percent more oil has been added to the nation's known reserves than has been consumed during the past year. The actual figure probably will be of the order of 2,250 million bbl. This, of course, includes extensions to known fields as well as new discoveries. Exclusive of the Hawkins field in East Texas, new discoveries alone, including many one and two well fields, have added an estimated 400 to 500 million bbl. to known reserves.

In this connection it should be borne in mind that recently discovered fields where time has not permitted extensive drilling are usually granted a reserve for estimate purposes of say 5 to 10 million bbl. although developments in the near future are likely to raise the reserve to the 25 or more million bbl. Hence, extensions to existing fields are bound to show up better in reserve estimates than are new discoveries. It may be assumed that most new discoveries during the last four months of 1940 are probably underated.

The outlook for new discoveries during 1941 is also highly encouraging. Not only are there a number of important provinces in the oil country which present knowledge reveals to have been inadequately tested, but preliminary exploration work is being carried on in important new areas such as North and South Dakota, Nebraska, Western Florida, Southern Louisiana and Mississippi.

To glance first at the situation in regard to the tools of exploration:

As Dr. E. E. Rosaire has ably pointed out, the development of each major advance in geophysics has resulted in a substantial increase in discoveries, after which the new method has declined in value as the more obvious prospects are drilled up. The reflection seismograph has enjoyed an unusually long and useful life, but it must be assumed that it is coming to the end of its usefulness for broad general discoveries. No doubt this method will be used for many years to come for more detailed work, but many of the most obvious prospects, discoverable by this method, have already been drilled. As a result of the end of the spectacular period in the life of the reflection seismograph it may be anticipated:

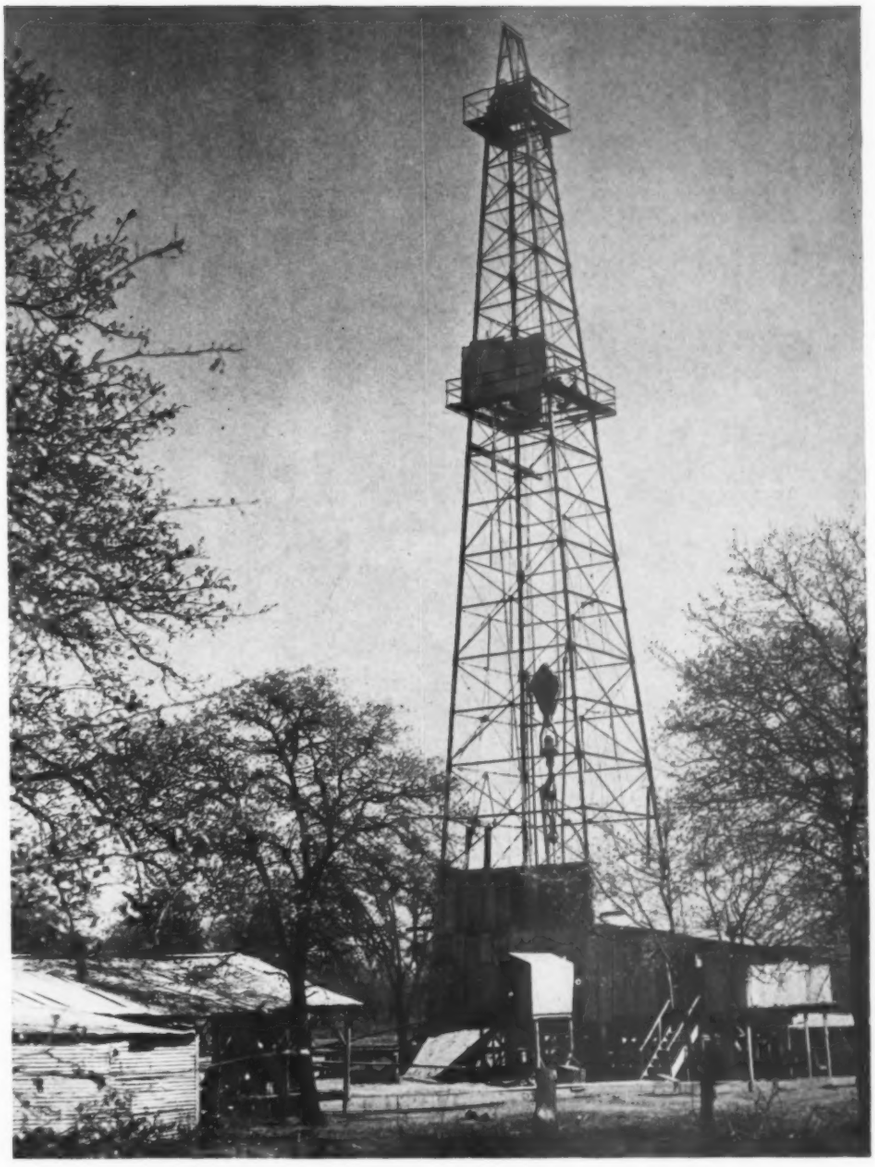
1. That the exploration branch of the industry will place greater reliance on straight wildcat drilling.
2. That there will be more extensive use of slim hole drilling with Schlumberger surveys and Baroid continuous mud analysis, with development of even slimmer hole tools with electrical contacts connected directly to the bit.
3. That some type of new geophysical method employing direct electrical methods to discover structure will develop out of the extensive research and experimentation now being devoted to this problem. Present patent situation is so complex as to make information on the extent and direction of such research difficult to acquire, but it is well known that much of this work is now in progress.

While the past year's exploration has been on the whole entirely satisfactory, it has not been without negative developments. One of these has been Oklahoma which has not yielded results commensurate with the work that has been expended there. Geological evidence indicates that southwestern Oklahoma is a non-productive area and exploratory drilling is costly due to the depth at which it has been assumed that possible new reserves must lie. Here exist some of the most complicated structures in the United States and it is safe to assume that much time must elapse before this province is adequately understood as to structure stratigraphy.

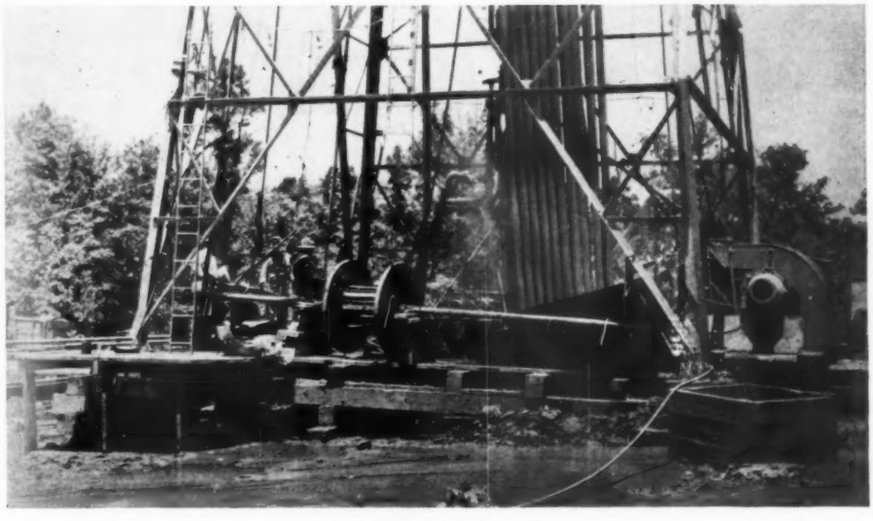
Northern Louisiana and southern Arkansas also proved disappointing during the past year. No important discoveries were recorded

despite considerable drilling activity. It is unlikely that anything important will be developed in this section during the coming year. Indiana for which high hopes were entertained at the beginning of the year has proved mediocre and probably will not enjoy a very active exploratory campaign during the coming year. New York, Pennsylvania and Ohio also may be removed from the list of prospects for new discoveries during 1941.

On the positive side, however, the brightest spot is Wood County in East Texas where tests drilled in the Southeast corner of the county near Hawkins went into the Woodbine sand several hundred feet higher than the nearest Woodbine wells. While very little information in regard to the well has been released, it is reliably reported that several hundred feet of saturated Woodbine has been cored and it is obvious that a major discovery is in prospect. This area has had a number of ups and downs since Manziel spudded in during September of last year. About the middle of October reports stated that the Manziel well had run into the Woodbine 300 ft. higher than the nearest test and was coring saturated sand from 4,909-23 ft. A considerable leasing play followed and when the Manziel well was finally tested it was said to have produced 90 percent water and 10 percent 19 gravity oil. The leasing activity received a severe setback. Meanwhile Manziel proceeded to deepen his well on the assumption that the Woodbine had been incorrectly identified and shortly thereafter, some 17,000 ft. southeast of this location Jackson & Rotondi proceeded with the drilling of another well. By the first week in December, the Manziel well had tested 288 bbl. of oil of 23 gravity and 192 bbl. of water in 24 hours on the pump. Casing pressure was said to be 210 lbs. Reports subsequently appeared that the Jackson & Rotondi well was running substantially higher than the Manziel well and finally that it had topped the Woodbine at 4,400 ft. with saturation extending to 4,650 ft. Recent developments indicated that Manziel's well was off structure to the north and west but tests were continued to attempt to complete this well as a commercial producer. The area around the Jackson & Rotondi discovery well is held almost entirely by Humble Oil & Refining Co.

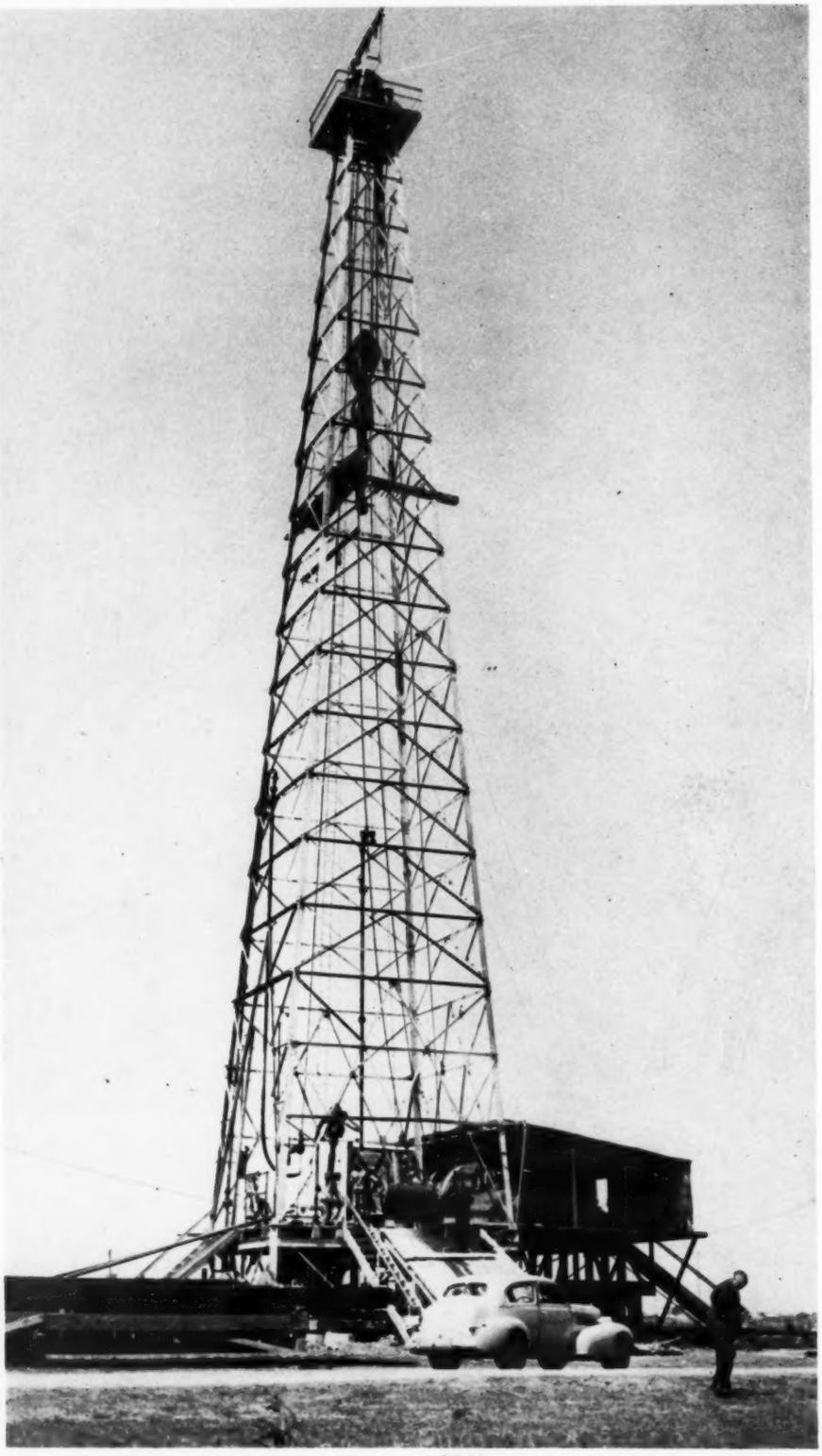


1940: *Southwestern Oklahoma proved disappointing—deep drilling and complicated structures.*



1940: *The Wilcox trend extending from Louisiana across Texas promises good future results.*

An important development in Texas for the future will undoubtedly be the extensive Wilcox trend which extends southwest from the Mississippi River across the entire southern portion of the state of Texas. Although the Wilcox is already credited with a reserve of several million bbl. recent studies indicate that it is far more extensive and prolific than originally supposed. Enormous in extent, it is probable that the Wilcox trend will present a vertical section of 2,000-3,000 ft., although



1940: ***Year's end saw a major development in Wood County, Texas, active drilling (above) in other parts of the state.***

how much of this section may be productive it is still too early to say. Further information is essential but every indication is that the Wilcox trend will ultimately prove as significant as any other area in Texas.

In the Texas Gulf Coast Humble opened a new field on submerged land in the Fisher's Reef prospect of Galveston Bay where the company's 8,961 ft. well flowed 24 bbl. per hour of 32.6 gravity oil through ¼-in. choke under 1,500 lbs. tubing pressure on preliminary tests. The same company was carrying on promising tests on two Red Fish Reef locations nearby in Galveston Bay, results of which are not yet available. Gulf Oil Corp. was drilling an off-set to Humble's Red Fish Reef test.

A possible major development in Texas is foreshadowed by work now being carried on in the south end of the West Texas Permian Basin which may result in doubling West Texas reserves . Also in the West Texas-New Mexico Basin an active pre-Permian play is anticipated during the coming year.

Other discoveries during the past year in Texas were:

Kadane discovery well east of Griffin Pool in northwestern Archer County which flowed 87 bbl. through ¾-in. choke in one hour in a brief test. Stanolind is laying a six inch pipe line to this well.

In Bayler County, British-American flowed 33 bbl. in 10 hours through open tubing from 2,518 ft. in its No. 1 J. H. Turbeville on the Claude Cowan fee.

In South Texas, the Davis field resulted from a discovery 15 miles southwest of Hebronville in Jim Hogg county. From 2,800 ft. the well produced 85 bbl. per day on ¼-in. choke. Oil is 26 deg. Mirando type with paraffin base. While a small field, it is typical of a number of such discoveries made recently on the Mirando Trend.

Also in South Texas, Royal Oil and Gas Corp. completed a discovery 7,500 ft. east of the Samfordyce in Hidalgo County producing 86 bbl. per day through 9/64 in. choke. In nearby Duval county Magnolia Petroleum Co. opened a new field 7,550 ft. northwest of West Casa Blanca field. The new well flowed 75 bbl. per day of 21 gravity oil through 3/8 in. choke. Pan American brought in a new discovery in Willacy County for 265 bbl. per day 30 gravity oil, through ¼ in. choke from 7,670 ft.

As the year closed important tests were scheduled on wells in southeastern Lavaca and Calhoun counties, and an active drilling campaign was being carried on on the east side of the Old Ocean field which had not been defined to east and southeast at the close of the year.

In Oklahoma, the location of a number of new wildcats indicated renewed interest but the past year showed little new development of a significant nature.

Next in importance to the actual discovery in Wood County, Texas, is the work that is being done on the Barton Arch which for a number of years past has been productive in Western Kansas. Indications now are that these developments have been confined to the southern portion of the arch and that it may well extend across Nebraska and into South and North Dakota. There is also reason to believe that the northern end of the Barton Arch may be as prolific as the southern end has proved to be. Carter Oil Co. has been active in acquiring leases in North Dakota particularly in the area around Bismarck and several other interests have recently appeared in the vicinity. Activity has assumed the proportions of a lease play and it is expected

that the first test will be spudded during April of 1941. Standard of California, Continental, Phillips, Carter, and Gulf have been doing geophysical work in northern South Dakota and on a line northwest across North Dakota almost to the Canadian border. In Nebraska there has also been a very active leasing campaign which has resulted in Carter Oil Company and others acquiring 500,000 to 700,000 acres mainly in Harlan, Furnas, Phelps and Gosper counties. Several of the companies interested in Nebraska are forming new corporations under Nebraska state law to represent them in this lease and development play.

In Kansas, during the past year, a total of 29 new fields were discovered, including Cities' Service's Phillips County Well which came in for 2,135 bbl. per day and is classed as one of the outstanding discoveries of the year. Oil from this well is 32 gravity.

Elsewhere throughout the country the situation may be classified as follows:

In central Louisiana the Wilcox trend may be said to have added 100-150 million bbl. to the nation's reserve during 1940 while in the Gulf Coast area it is expected that considerable work may be done on the flanks of known salt domes.

In Michigan there are promising indications of deep production in Bay County.

In Florida, Humble is said to have acquired about 700,000 acres in Escumbia County. Peninsula Oil & Refining, a Humble subsidiary, has opened an office in Pensacola and is leasing in the area west of the Choctawatchie River. In Georgia, Carter is said to be actively leasing in the southern counties.

In Kentucky, McClure and Allen have located their No. 1 Albert Chism in Clark County seven miles southeast of Winchester in east central Kentucky. The well is intended to test the Ordovician on the western flank of the main Kentucky syncline. The well is intended to reach the St. Peter sand and its importance lies in the relative deepness of the test.

In Tennessee, several miles south of a shallow field in Kentucky, Sterling Oil & Gas Co. brought in a well in Pickett County flowing 200 bbl. per day from 520 ft. but the flow declined after a few days. Deeper drilling is now in progress.

While nothing definite has occurred in West Virginia during 1940, acreage is held in large block and some leasing has been apparent during the past year. It is possible that something may develop here during the coming year or two.

In California, there have been no new discoveries of importance during the year just past: but extensions of existing fields have added considerably more than has been produced during the year. Important extensions have occurred in East Coalinga, Rio Bravo, Greely, Coles Levy, Paloma and Huntington Beach fields.

In conclusion it might be pointed out that in addition to the important Hawkins field, the flanks of the Black Hills in the Dakotas, part of Mississippi, Southwestern Alabama, Western Florida and sections of Louisiana just west of Mississippi may be the scene of a major development during the coming year.

High Degree of Activity in REFINERY CONSTRUCTION Indicated for 1941.

Trend Toward Superior Quality of Products and Greater Utilization of Wastes Combining with Military Needs to Expand Output of High Test Fuels and Lubricants.

CONTRACTS now in process of execution and orders waiting to be placed foretell a period of great activity in refinery construction and modernization in the United States during 1941. One factor alone is holding up a number of ambitious programs which were expected to be put under way shortly after the first of the year. That is uncertainty as to what requests the Army, Navy and other agencies of national defense are going to present to refiners.

The oil industry as a whole has gone on record as being prepared to render any service that may be asked of it. It is able and willing to increase the production of 100 octane gasoline, of high test fuel for use in the training of aviators, of superior grades of lubricants needed by powerful and long range planes and of other special products that may be required in the process of arming the nation. It stands ready to expand storage capacity and to provide additional pipelines, tanker and terminal facilities in the shortest possible time. But it is obviously impossible for individual companies to anticipate the extent of these requirements or to proceed according to their own conception of what the needs might be. That might easily lead to surplus capacity for certain products and a dearth in the output of others. The task of determining what products are needed, in what quantities and at what time rests on the official representatives of the federal government. It is part of the national defense program but that program, except as to planes, ships and munitions, has not yet assumed a clear-cut form.

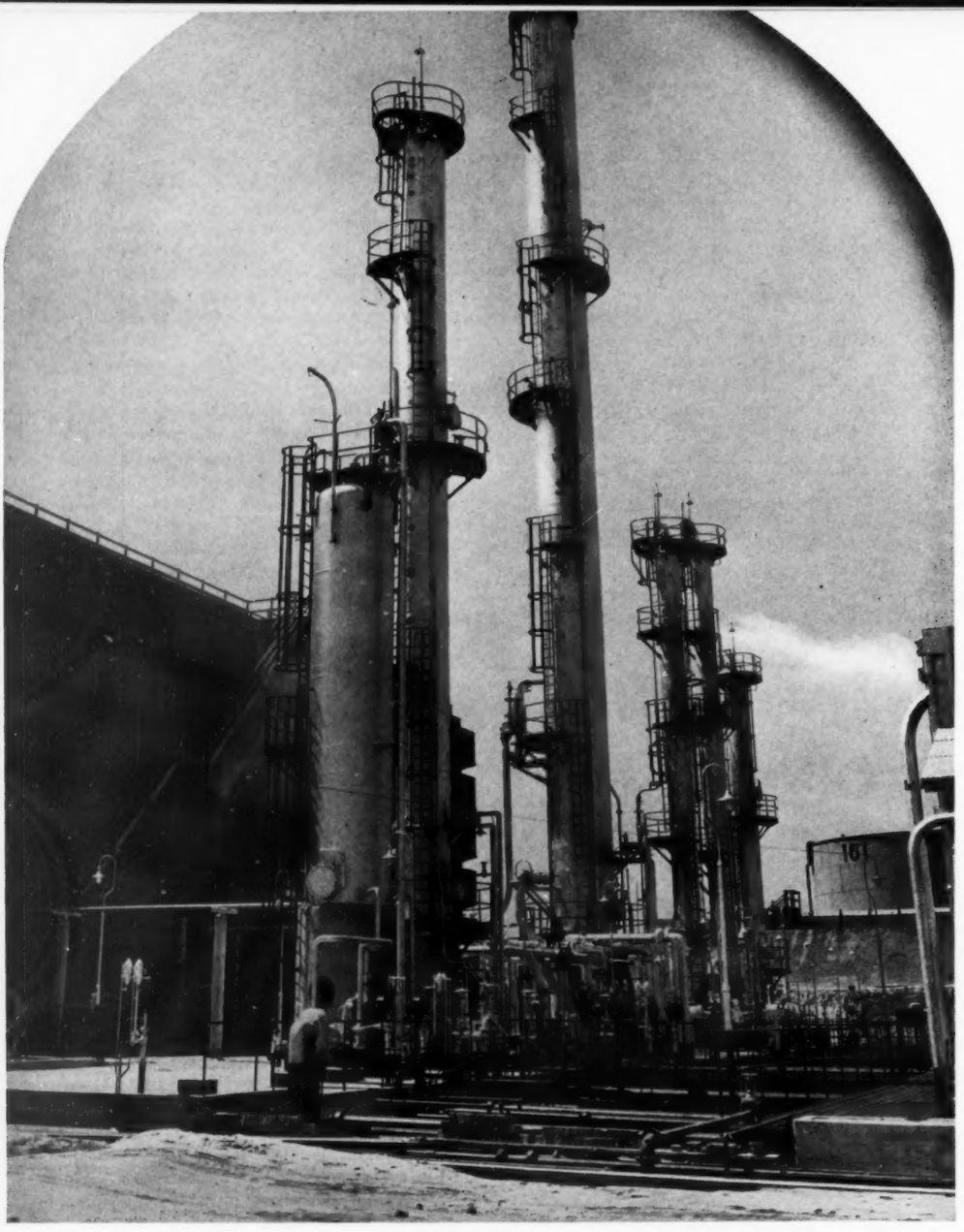
Certain arrangements have been made. Some three months ago the government entered into an agreement with the Humble Oil & Refining Co. by which the latter will expend more than $10,000,000 on a plant at Baytown, Texas for the production of toluol besides something more than $1,000,000 on additions to its existing plant. Erection of the plant is now under way. It is reported that certain other contracts have been placed although no public announcement of these has been made as in the case of the Humble Company.

In these instances it will be noted however, the primary purpose of the government is to provide munitions, although of course a great plant like the one going up at Baytown will produce large quantities of high test gasoline as an adjunct to its output of toluol. In this connection it may be mentioned that since toluene is present in practically all the naphthas obtained through heavy cracking there are many refineries that are in a position to contribute to the supply of toluol with an investment much less than that referred to above should the war take such a turn as to call for large additional supplies.

Numerous refiners have explored this subject and stand ready to engage in such production if the government so desires.

These provisions, as previously mentioned, relate to the manufacture of munitions as a petroleum by-product. As to the government's requirements of the more familiar and established petroleum products no clear cut statement has been placed before the oil industry as yet.

In the matter of aviation gasoline the National Defense Advisory Commission some months ago worked out a preliminary plan for meeting the expanding need for airplane fuel during the early stages of the plane construction program. This project was based on the realization that the present output of aviation gasoline was in excess of current demand and on the assumption that accumulation of a reserve sufficient for six months would allow time for production to be increased in step with later requirements as the number of planes increased. It provided for the creation of a Defense Materials Corporation, financed by the Reconstruction Finance Corporation, which would purchase and store aviation fuel selling it in turn to the Army and Navy as needed. Unfortunately the plan conflicted with legal restrictions and official regulations governing the purchase of sup-



1940: *A year of increasing emphasis on chemical aspects of refining.*

plies by the Army and Navy and apparently cannot be put into effect until these obstacles have been cleared away. It has not been abandoned and probably will be carried out sooner or later but meanwhile the policy of the government in regard to additional production of aviation gasoline has not been defined.

That additional supplies will be needed is obvious and from the viewpoint of the refining industry it is important that the government's wishes should be made known soon in order that the necessary plant construction may be put under way.

A recent letter addressed to the heads of leading refining companies by W. S. Farish, president of Standard Oil Company (New Jersey) in his capacity as chairman of the committee appointed by the American Petroleum Institute to represent the oil industry in cooperating with the government in defense measures, discussed the question of possible needs for aviation fuel. Mr. Farish stated that the production of 100 octane gasoline could be raised to 35,000 bbl. daily in the course of twelve to fourteen months by the construction of new plants or units at an estimated cost of $35,000,000.

Mr. Farish did not suggest the figure of 35,000 bbl. as representing the actual needs of the government at the end of the period stated but an analysis of the airplane program indicates clearly that if its objectives are realized this quantity and more will be required by the time airplane output attains full volume. Early action to provide this additional capacity is considered important because the growing demands upon steel mills by airplane manufacturers and shipbuilders indicates the possibility that deliveries of steel and other metals may be seriously delayed as time goes on, thereby extending the time required for completion of plants.

As planes capable of high speeds and long flights come into use a large demand for high quality lubricating oils will be felt. Two or three years ago it was considered that the lubrication side of the refining industry was over-built but with the prospect of an expanding need for lubricants capable of meeting the most severe requirements plans for a number of new plants employing solvent processes are under consideration.

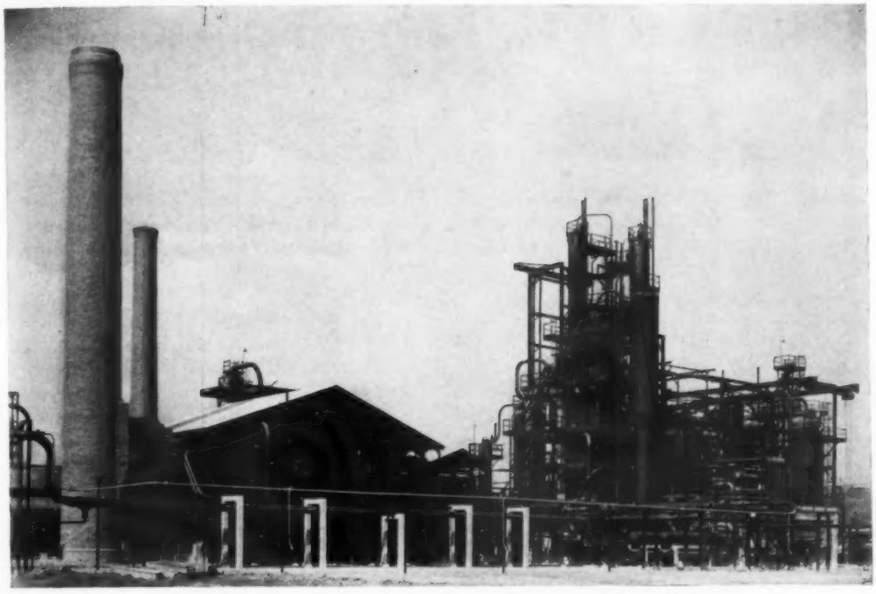
Another phase of the situation affecting aviation fuel and lubricants that is receiving careful study is the possibility of an increased export demand for these products as the war becomes more intensive. As is well known the export movement from the United States fell far below expectations during the first year of the war. The United Kingdom which is the only important market remaining open to American exporters has been so well served from Empire sources that its purchases actually have declined. Recent inquiry has been largely for alkylate to be used in blending in British plants.

As the number of planes in actual service is increased by growing British production and by additions from the United States, this may be expected to add to the increased demand for aviation fuel occasioned by the expansion of the American air force and to call for a larger volume of exports than is moving at present.

With the addition of large numbers of tanks and other mechanized equipment to the country's armament and with the training of air pilots at the contemplated rate of 3,000 per month a further demand for high test fuel is envisaged by those in charge of defense preparations. While 100 octane gasoline will not be required for these uses it will be necessary to have larger quantities of 91 octane than are now being produced.

In gearing the refining industry to the requirements of the defense program, therefore, emphasis will be placed on the provision of plant facilities for increased production of aviation gasoline, alkylate and to some extent probably of high grade lubricants. This is reflected in construction activities now under way and in others which are definitely planned to begin as soon as necessary authorizations are made for certificates of necessity permitting amortization of costs over a five year period as provided by Congress.

Aside from the needs of national defense there is another factor which is looked upon as strongly affecting the trend of refinery construction during 1941. That is the emergence of catalytic cracking as a practical and recognized means of increasing the recoveries of high test motor fuel. While a number of refineries have been engaged in catalytic cracking for some time the industry in general has been disposed to await the development and demonstration of various new processes which were in the laboratory or experimental stage before venturing the investment required for installation of any of these processes. Now that these methods have demonstrated their efficiency the number of catalytic plants and units is expected to increase rapidly not only for the treatment of reduced crudes and residues but also for



1940: ***Naphtha polyforming (above) and additions to Wood River (right) for production of 100-octane attracted widespread attention.***

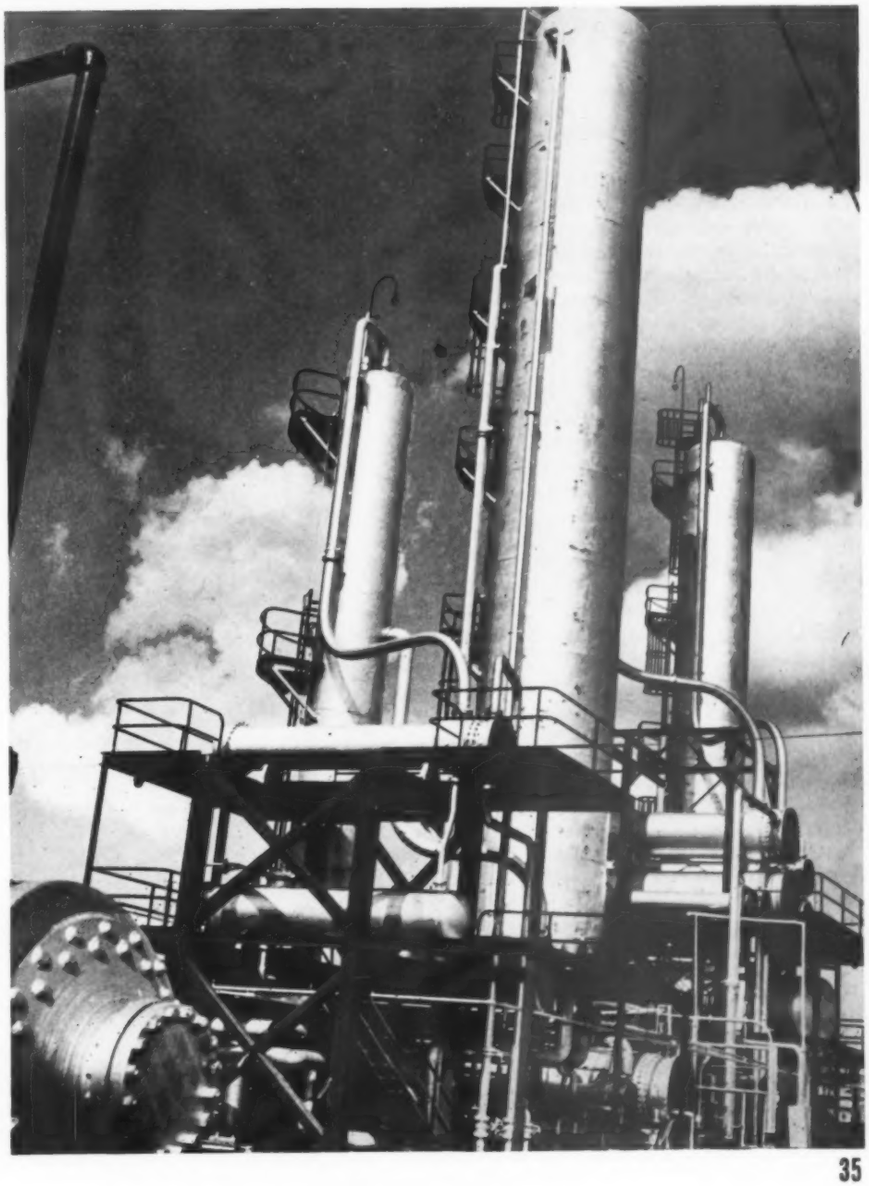
the polymerization of cracked gases. The advantages claimed for catalytic treatment in the matter of yields are expected to lead to its adoption in a growing proportion of new plants though they are not regarded as sufficient to justify the displacement of up-to-date thermal plants which have available other recently developed methods for converting their gases into high octane products.

Though temporarily overshadowed in discussion by consideration of purely defense needs the trend toward higher octane continues unabated. The movement in this direction is a continuous process which in the case of most refiners must be carried out step by step. The movement in this direction is being greatly accelerated by developments in connection with the war and it is increasingly realized that refiners who neglect modernization of their plants now will find themselves in a very disadvantageous position after the war is over.

Advance reports from refining companies and engineering firms indicate that what may be called normal construction, that is to say plant erection and improvement to meet the growth in commercial demand for petroleum products, will be about the same in 1941 as in the year just ended. Superimposed on this will be a considerable amount of work either wholly or primarily dictated by military needs. The extent of the latter will depend upon the rapidity with which this phase of the defense program is defined and put into full operation. Reports from Washington are that the situation will be cleared up very shortly.

Construction work already in progress by half a dozen of the larger refining companies entails an expenditure of some $75,000,000. One engineering firm alone reports that it has under way eight catalytic cracking plants and three alkylation plants while several others are in the drafting table stage. Other contracts reported as definitely approved are sufficient to double the above mentioned outlay. Adding to this the amount of defense work already in progress or likely to be authorized within the next three months indicates that the coming year will be one of exceptional activity in the field of refinery construction and modernization. Not only in the volume of work but in point of technical advance as well, 1941 promises to be a year of outstanding progress and to carry still further the improvement in products and the utilization of former wastes which has been the unvarying record of the refining industry for many years past.

While reference has been made in this discussion to refinery construction in the United States activity in other countries is by no means at a standstill. Particulars of such enterprises are withheld because of war conditions but it can be said that they will contribute materially to the total of the year's building operations.



FINANCIAL OUTLOOK For 1941 Encouraging

By Henry E. Rose

Reduced Gasoline Stocks With Prospects of Increased Domestic Demand for Gasoline Constitute Favorable Factors Surrounded by Uncertainties Arising from Renewed Drive for Federal Control and Dislocation of World Trade.

ANY attempt to forecast the future of the American oil industry—even during the next few months—must give due weight to certain possibilities which may alter its course. These are present largely because of wars, and economic and political disturbances throughout the world, any one, or all, of which could exert a vital influence on this country's industry.

Moreover, oil has become a political as well as an economic issue in the United States. A recurrence of efforts on the part of certain administration leaders to exercise federal control over the industry developed recently. President Roosevelt, in a confidential letter to Congressman William P. Cole, chairman of the House Oil Investigating Committee, declared that urgent and critical need has arisen for such control "without further delay" in view of the international situation and its effect on world oil supplies.

The chairman of that Committee scheduled hearings in mid-December at which members of the National Defense Advisory Council, representatives of the Department of the Interior (Interior Secretary Ickes said only a short time ago that he favored control from the well to the filling station), and the Association of American Railroads, were to testify. The hearings were postponed, but are expected to be held shortly. The question arises: Does there exist a need for federal control?

The industry, at no time in its history, has failed to supply all demands made upon it and, in fact, is today probably the only basic industry in a position amply to provide for all requirements under the national defense program. Both crude production and refinery capacity can be increased materially if necessary. Unused refining capacity is approximately 1,000,000 bbl. of crude oil a day, or potentially 25 percent more than is being utilized at present.

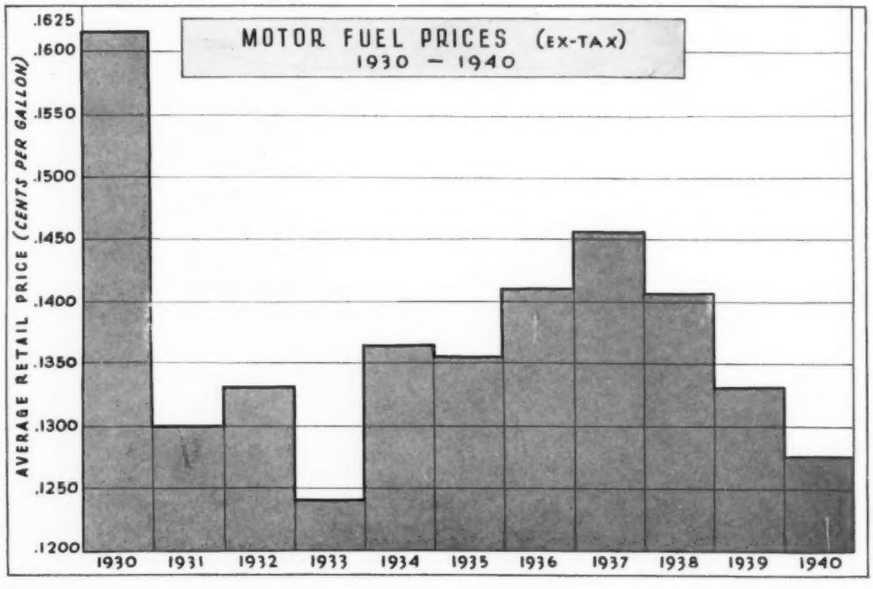
Fundamentally, therefore, the emergency, or necessity, for federal regulation does not exist. The mere fact that the proposal has administration support, furthermore, does not give assurance of its passage. The threat of regulation, however, prevails and must be considered in charting the industry's future course.

Just what pattern federal control would take, if it were imposed, is unknown. Needless to state, the industry, almost unanimously, is opposed to being put under the direction of the federal government. It contends, and rightly, that there is sufficient control by the various states, the Interstate Oil Compact Commission, and the Connally Hot Oil law which prohibits the transportation of illegally produced oil in interstate commerce, to prevent wasteful production of this important natural resource.

The outcome of the recent national election, moreover, would indicate that renewed attempts might be made to force disintegration of the integrated units in the industry, especially in the form of divorcement of pipelines and marketing. That pipeline segregation may be in the offing is apparent in plans of the House Committee to seek the testimony of representatives of the Association of American Railroads. The rail carriers are steadily losing oil revenue as the country's pipeline facilities expand.

These are several reasons why it is difficult to make reasonable predictions. Were they eliminated as factors, the task of forecasting would be simplified.

Disregarding them, it appears that the industry, as it has been functioning in recent months, is destined for more profitable operations in the new year. Oil products of all kinds, according to economists, will be in



Factors in 1940 Financial Results

	*Total Oil Demand (bbls)	*Taxes Paid By Industry	Average Service Station Price Gasoline Cts. per Gallon	*Net Profits 23 Cos.	*Funded /and Long Term Debt 23 Cos.
1940 (est.)	1,450,000	$1,500,000	12.75	$370,000	$910,000 (1)
1939	1,417,819	1,354,166	13.31	341,135	922,310 (2)
1938	1,330,850	1,286,114	14.07	324,718	855,540 (3)
1937	1,342,516	1,315,488	14.59	607,404	628,150 (4)
1936	1,224,748	1,183,147	14.10	443,340	542,113 (5)
1935	1,112,672	1,121,937	13.55	275,614	574,475 (6)
1934	1,034,672	1,046,150	13.64	175,704	647,485 (7)
1933	975,214	1,004,824	12.41	99,937	770,407 (8)

(*) Last 000 omitted.
(1) For 20 companies; (2) for 20 companies; (3) for 18 companies; (4) for 15 companies; (5) for 18 companies; (6) for 17 companies; (7) for 17 companies; (8) for 17 companies.

1940: ***Saw the beginning of a great tankship construction program as tanker rates skyrocketed adding to the cost of fuel oil in the industrial ports on the Atlantic seaboard.***

record demand, so far as the United States market is concerned, probably as much as eight percent higher than in 1940, although some estimates will not go beyond five percent. Even with the loss of substantial foreign markets because of the European war, a net gain in the volume of business should result. During 1940, oil exports of all kinds declined approximately 30 percent from 1939; gasoline offshore shipments were down almost 50 percent, but the gain in domestic consumption practically offset this.

Larger consumption for 1941 is predicted on increased industrial activity incident to the national defense program. The latter will take up part of the slack in unemployment and thus augment national income which, in turn, will be translated into increased sales of automobiles, trucks, tractors, oil burners and other oil consuming devices. Furthermore, as mechanized equipment for defense rolls off the assembly lines and is placed in service, the demand for oil will be lifted correspondingly.

Anent business in 1941, Colonel Leonard P. Ayres, vice president of the Cleveland Trust Co., and one of the country's leading economists, recently said that the defense program "is by far the most important factor in the prospects for general business in 1941," for which year a boom is on the way. He added that the course of business in 1941, the following year, and perhaps for a still longer period, will be shaped by this country's decisions to become a strongly armed nation and to extended "unstinted aid" to Great Britain. Col. Ayres is on leave of absence from his bank duties and is now serving as chief statistical officer of the War Department.

For the major part of 1940, the oil industry in the United States overproduced crude and maintained refinery operations at uneconomically high levels with the result that prices for the principal product—gasoline—became steadily weaker until at the year-end the average for 50 leading cities was at a seven-year low.

In recent months there has been a definite effort at correction of the unsound practices which prevailed during the early part of the year. Crude production has been more nearly in balance with demand, refinery runs have been curtailed and seasonal accumulations in gasoline stocks have been only moderate.

Overproduction of crude oil in the first eight months of 1940 was evidenced by the addition of 25,340,000 bbl. of crude to storage above ground. Moreover, it was concealed partly in illogically high runs to refineries which converted the crude into refined product inventories. Since the end of August the production situation has been in better balance and some withdrawals have been made from crude stocks. At the year-end these stocks approximated 260,000,000 bbl., the equivalent of slightly more than 70 days' requirements, which is not considered burdensome.

Texas, which had set its allowable production at levels above the recommendations of the U. S. Bureau of Mines most of the year, contributed largely to the rise in crude stocks. The increment in Texas crude to inventories above ground, in the first ten months of 1940, amounted to almost 14,000,000 bbl., or about 65 percent of the total increase to the end of October. The realization that Texas' output was too high was somewhat belated, although repeated warnings had been issued, and it was sometime before the state began to adjust its proration schedule in line with demand.

Meanwhile, several adjustments, rather than reductions, were made in Texas crude oil prices during December, especially in higher gravities from Gulf coastal fields. It is not expected that a general downward revision in prices will materialize in the southwest, but that additional adjustments, similar to those mentioned, may take place in other areas. These are predicated chiefly on low prices for gasoline, since Texas is the most important factor in the export market and the backing-up of motor fuel has depressed prices to unprofitable levels in terms of crude oil costs.

During the year Illinois virtually ceased to be a factor in the unbalanced production situation. Its output began to decline sharply in mid-May and has continued the downward trend to the present time. Currently the state's production shows a drop of about 190,000 bbl. daily to a level below the estimated recommendation of output by the Bureau of Mines.

As for refinery activity, this has been maintained around 3,480,000 bbl., daily in recent weeks, a level considered not excessive since the normal seasonal increases in gasoline inventories have not been materializing as in previous years. In fact, the addition to gasoline inventories since October 1, last, when the period of 1940 heavy demand terminated, to December 31, was about 1,000,000 bbl., an unimportant total when compared with the 11,873,000 bbl. placed in storage in the corresponding period of 1939.

From present indications, it appears that the industry will go into the 1941 period of heavy consumption beginning April 1, with gasoline stocks from 7,000,000 to 10,000,000 bbl. less than a year earlier, when they were at the unprecedented peak of more than 103,000,000 bbl., and contained a potential surplus of 20,000,000 bbl. The improvement in the stock position should be reflected in a strengthening market for gasoline.

During 1940 the gasoline price structure witnessed a steady downward trend. For 50 leading cities throughout the country, the net dealer price averaged 9.78 cents a gallon, before taxes, on January 1. It declined to 8.46 cents by December 1, a reduction of 1.32 cents a gallon. For the year it averaged 9.11 cents, the lowest in the history of the industry, and compared with 9.58 cents a year earlier. The previous low for the yearly average was 9.41 cents a gallon in 1933.

The extent of the price decline, however, has not been uniform for this major product, and this accounts for relatively better profit showings by companies operating in certain areas as compared with units in other sections. Eastern and Gulf coastal areas, and the Pacific coast were especially hard hit, while the interior experienced a fairly stable price structure during the year. This is demon-

strated in the accompanying table showing average undivided dealer prices in leading cities at various times during 1940.

Undivided Dealer Price for Gasoline in Representative Cities During 1940

	(Cents per gal.)			
	Eastern Seaboard	Interior	Pacific Coast	U. S. Average 50 cities
Jan.-Mar.	8.79	9.32	11.22	9.71
Apr.-June	8.24	9.31	10.78	9.22
July-Sept.	7.49	9.31	9.89	8.84
Oct.-Dec.	7.00	9.23	9.89	8.58

The gasoline price trend is a vital factor in profits of the industry since that fuel is its principal money product. The first quarter results, in reflection of higher prices, were the best in 1940, although normally, because of a decline in demand, it is the poorest. The second quarter, which normally is one of the best for the industry, suffered a slight reaction in profits from the preceding period, and the third quarter, normally a good one too, reflected a further setback.

Capital expenditures of the American industry during 1941 are unlikely to measure up to those in the previous year, for several reasons. These include: (1) uncertainty as to the future because of disturbed world economic and political conditions; (2) the threat of federal control or a drive for disintegration; (3) increased taxes and the prospect of still higher levies as the defense program is more fully developed; (4) the longer term required to pay out on new wells in accordance with stricter proration of output; (5) the virtual cessation of operations in European countries of affiliates of American companies, and (6) the enforced slowing down of development work by U. S. com-

1940: ***Illinois under control, no longer a first class menace to nation-wide proration: numerous small fields discovered in Eastern part of basin.***

panies in South American countries because of the loss of European markets. In a normal year the industry spends about $750,000,000 for capital purposes the larger part in development of new reserves.

For the defense program the only possible expansion to be undertaken by the industry will be in providing additional refining capacity to produce super aviation fuels, although at present this capacity is ample for present and normal prospective needs for the near future. There may also be some pipeline construction to furnish supplies to strategic areas, and additional construction of storage facilities. Aside from this, the industry, as stated previously, is ready to go when the signal is given.

Last year's profits of the industry, on indications, probably slightly exceeded those in 1939, even though there was a tapering off in the final half incident to lower gasoline prices. For 23 leading companies whose shares are listed on principal exchanges, the net income, in all probability, aggregated $370,000,000, equal to about $1.90 a share on the combined shares of common stock outstanding. For 1939 these companies earned $341,134,880, equal to $1.78 a share of outstanding common stock. The record was established in 1937 when net totaled $607,423,900, equal to $3.20 a share of common stock.

Cash dividend payments by the 23 companies on their common stock last year totaled $208,000,000, an increase of about $23,000,000 compared with 1939. It should be pointed out, however, that Standard Oil Co. (N. J.), in 1939, also disbursed a dividend in stock, amounting to 2½ percent, which, when converted into cash, would have lifted the 1939 payments to almost the same amount as distributed in 1940.

Standard made only cash payments in 1940, aggregating $1.75 a share on its capital stock. This compared with $1.25 a share in cash during 1939, plus the stock dividend mentioned above. In the final half it paid an extra of only 25 cents in cash, with the usual semi-annual of 50 cents. Accompanying this payment to stockholders was a memorandum that the directors decided on the smaller extra because of the loss of European business and low prices for refined products in the domestic market, with a consequent effect on earnings. Moreover, it was deemed desirable to conserve cash for eventualities growing out of unsettled world conditions.

Other changes last year included payments of only 60 cents a share by Barnsdall Oil Co. against 90 cents in 1939; 72½ cents by Consolidated Oil Corp. against 80 cents; 45 cents by Ohio Oil Co., against nothing in 1939; 80 cents by Mid-Continent Petroleum Corp. against 60 cents; 75 cents by Shell Union Oil Corp. against 50 cents; $1.25 by Skelly Oil Co. against 75 cents; $1 by Standard Oil Co. of California against $1.10; $1.50 by Standard Oil Co. (Indiana) against $1.25; $2 by Standard Oil Co. of Ohio against $1.50; 70 cents by Tide Water Associated Oil Co. against 80 cents and $1 by Union Oil Co. of

California against $1.05 during the year 1939.

The new year is likely to witness a number of refunding operations by the industry since idle funds in the country's banking institutions expanded materially during 1940 as the result of capital flight from European nations which became involved in the European war. At the year end, for example, Phillips Petroleum Co. concluded negotiations for refinancing its $25,000,000 of three percent convertible debentures by an offering of $20,000,000 of new ten-year convertible debentures bearing interest of 1¾ percent and borrowings of $15,000,000 to be evidenced by ten-year serial notes.

Standard Oil Co. of Ohio is discussing the possibility of retiring its $12,000,000 of $100 par six percent preferred stock, and replacing it with a $15,000,000 issue of debentures bearing a lower interest rate. Ohio Oil Co. also has been negotiating for redemption of all, or part, of its preferred stock and its replacement by lower rate borrowings.

Aggregate Profits for 22 Companies

	1940	1939	Percent Change
March quarter	$43,537,000	$13,196,000	+230%
June quarter	38,661,000	22,465,000	+72%
September quarter	29,203,000	32,947,000	—11%

The course of aggregate profits, by quarters last year, is shown in the preceding tabulation for 22 companies which issue interim reports, compared with similar periods in 1939; with percentage changes:

For 27 companies reporting for the first nine months of 1940, net income aggregated $114,191,950, an increase of 59 percent over the corresponding period in 1939. While the September quarter results were below a year ago, the gain in first half profits last year was sufficiently high to enable a continued good showing for the nine months.

The profits of these 27 companies are shown in the accompanying table compared with the similar nine months in 1939, together with increases, or decreases; as well as six months' results for several companies which report only on a semi-annual basis:

Six Months Reports, Period Ended June 30

	1940	1939	Increase
Sun Oil Co.	$ 4,973,265	$ 1,085,898	$ 3,887,367
Socony-Vacuum[1]	25,000,000	17,000,000	8,000,000
Standard (Indiana)	20,497,223	14,979,694	5,517,529
Pure Oil	4,700,000	2,433,456	2,266,544
Consolidated Oil	2,080,027(d)	872,671	2,952,698
South Penn. Oil	1,823,312	890,192	933,120
Totals	$59,073,827	$35,516,569	$23,557,258
Standard (N. J.)[1]	$85,000,000	[2]	

[1] Officially estimated.
d Deficit.
[2] Not available, but for full year, 1939, net was $89,128,756, equal to $3.26 a share of capital stock.

Because of present subnormal prices for gasoline and the prospect that there will be no improvement until the spring, it is expected that profits in the initial quarter of this year will show a sizeable diminution compared with the extraordinary good similar period in 1940. As the gasoline consuming season progresses, however, and demand increases, the indications are for betterments in the June quarter as against the preceding three months.

A factor influencing this year's profits of the oil industry, and, in fact all industries, will be higher normal federal income taxes, and, in a few instances, the impact of excess profits taxes will be felt. Anent the latter, oil, because it is a natural resource industry and enjoys certain exemptions because of the risk involved in discovering it, is less affected than manufacturing industries. However, the rise in normal taxes, from 18 percent to 24 percent on corporate income will affect earnings.

Under the Second Revenue Act of 1940, either of two methods may be employed in calculating credits for excess profits taxes. Briefly, one is to use 95 percent of the average annual net income during the base years of 1936 to 1939, inclusive, while the other provides for eight percent on invested capital. In the latter instance, borrowered funds are included at only 50 percent of their total.

On available records of earnings and investment—a poor yardstick but the only one available—the industry as a group will employ the invested capital option of reporting earnings for taxation on the excess profits basis.

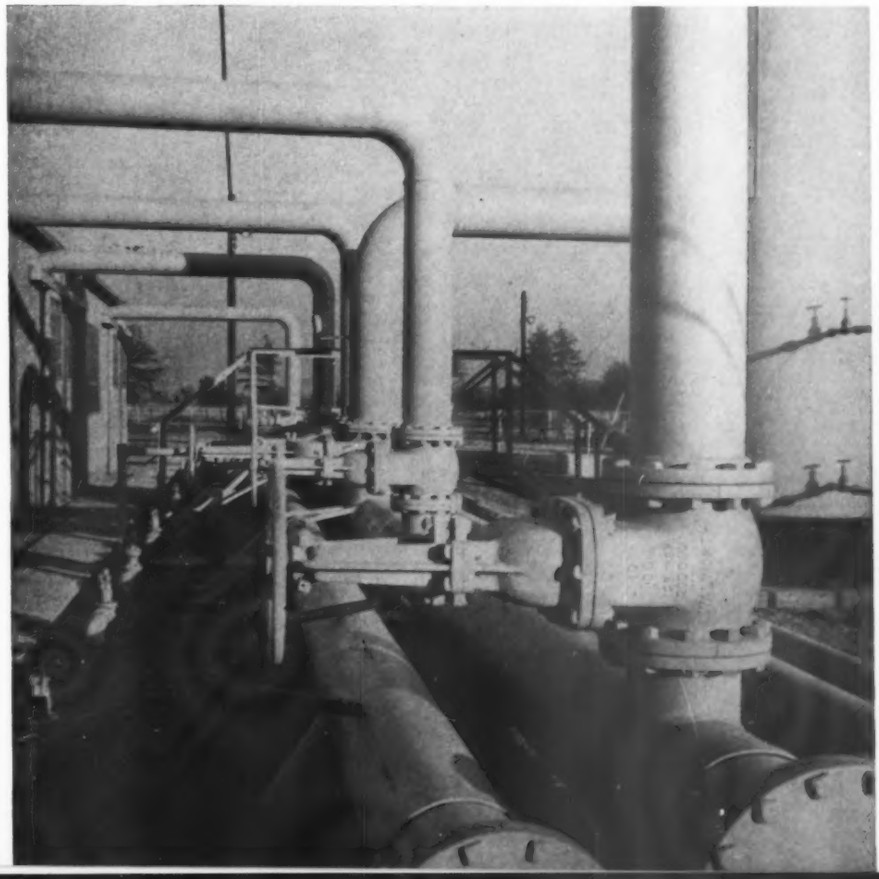
Average annual net income of 30 leading companies during the base period was $442,053,983, or 6.5 percent on the indicated aggregate investment of $6,796,432,977. Since under this option, only 95 percent of the base period average earnings are allowed as a credit against excess profits taxes, the average credit of these companies, as derived from stockholder figures, would be only $423,700,000, or 6.2 percent on investment. Under the invested capital option, the credit would be eight percent of investment, or $544,000,000.

This credit would permit the average rate of earnings to increase materially above the $353,783,343 shown by these same companies in 1939 before a balance taxable as excess profits would be reached. Companies engaged solely, or almost entirely, in production, and pipeline concerns, probably will report under the average earnings option since their return on invested capital is in excess of the eight percent credit permitted under the tax law.

Profit and Loss First Nine Months of 1940

	1940	1939	Inc.	Dec.
Skelly Oil Co.	$ 2,251,905	$ 1,366,245	$ 885,660	
Quaker State Rfg.	244,931	1,091,547		$846,616
Texas Corp.	33,692,712	*17,500,000	16,192,712	
Tide Water Associated	7,057,625	4,380,318	2,677,307	
Atlantic Refining	5,660,394	3,130,000	3,430,394	
Phillips Petroleum	8,778,533	5,479,057	3,299,476	
Plymouth Oil	1,231,188	1,673,366		442,178
Seaboard Oil	891,859	1,169,588		277,729
Shell Union Oil	12,615,196	6,710,658	5,904,538	
Texas Pac. Coal Oil	348,126	617,802		269,676
Union Oil (Cal.)	3,212,612	4,549,718		1,337,106
Continental Oil	3,299,631	4,065,842		766,211
Superior Oil (Del.)	125,056	21,684	103,372	
Standard Oil (Cal.)	16,730,170	12,640,899	4,089,271	
Wilcox Oil Gas	72,771	290,468		217,697
Derby Oil Refining	95,317	69,827	25,490	
Houston Oil	637,738	618,967	18,771	
Sunray Oil	323,002	418,050		95,048
Universal Consolidated Oil	228,119	511,125		283,006
Ohio Oil Co.	7,153,891	120,412	7,033,479	
Texas Gulf Producing	482,414	414,237	68,177	
Mid-Continent Petroleum	2,607,522	1,119,353	1,488,189	
Standard Oil (Kansas)	67,102 (d)	29,383	96,485	
Richfield Oil (Cal.)	3,066,584	1,858,616	1,207,968	
Lion Oil Refining	459,325	398,177	61,148	
Louisiana Land and Expl.	633,350	407,804	225,546	
Amerada Corp.	1,324,877	783,625	541,252	
Totals	$114,191,950	$ 71,377,982	$47,349,235	$4,535,267
Net Increase			$42,813,968	

1940: ***Pressure maintenance comes of age.***



Defends Purposes of South American Institute of Petroleum

To the Editor of World Petroleum:

THE November 1940 issue of WORLD PETROLEUM includes a communication, the author of which is not named, making reference to my plan for creating a South American Institute of Petroleum, which had been presented in the September issue of the magazine.

The author goes into a long discussion of the inconveniences arising, according to his opinion, from the policy of petroleum nationalization adopted in some South American countries. To this I will refer separately as the importance of the question requires. He further states several categoric affirmations ascribing to my plan a definite view of lending the South American Petroleum Institute to a propaganda in favor of government property extension to the South American petroleum fields, and the consequent elimination of private industrial and commercial activities in this continent.

I firmly assert that this statement is absolutely rash and based on no reason at all. As evidence of this I need no more than refer to my own conclusions submitted to the Unión Sudamericana de Asociaciones de Ingenieros on June 17, 1940. I mentioned precisely as one fundamental phase of the future institute, the necessity of establishing close connections between South American technicians, comprising the petroleum engineers and chemists of this continent and including the development of fields, the refining of raw materials and the commercial marketing of the finished products. Therefore, both the government technicians and those of the private industry are definitely involved, as must be the case in an institute which will be fundamentally technical and not political, either from the economic or the international viewpoint.

The same leading idea, without any political view, was evidenced in my proposition applying to the acceptance of future protecting members, when I included the private companies working for the development of the petroleum industry, in the three aspects already mentioned, which are or shall be in activity in South America.

My original statements, here abstracted, therefore should enable any unbiased observer to realize that the proposed institute would gather every expression of the South American petroleum industry; those answering to the prevalence of the government influence as in the case in Argentina, Bolivia and Uruguay, as well as those supporting the action of the private industry as in Venezuela, Colombia and Peru.

I was therefor far from the idea of restricting the action of the future institute within a definite trend right from its start. Although my personal views might lead toward a specific tendency, I could never pretend to the monopoly of wisdom in this matter nor possess the secret of the ideal solution in such an arduous problem, which deserves the attention of the whole world and leads to never-ending polemic and study.

I have thus considered and still consider that the adoption *a priori* of a definite tendency in a delicate affair such as the policy to be developed economically in the South American petroleum industry, would cause the new organization to come into existence encumbered with errors which would prevent the large development it has to reach and will reach on any other procedure.

The Board of Directors of the U. S. A. I. also understood this on supporting my plan, and the Provisional Organization Committee, which recently held a meeting in Buenos Aires, ratified this tendency on deciding to include in the Provisional by-laws of the institute, the wording of which has been entrusted to me, the following clauses defining the purposes which lead to its formation:

1) To encourage and coordinate the study of petroleum in all its aspects, i.e., exploitation, elaboration and marketing of petroleum and its allied products by means of inter-change of information. To assist and finance investigations and to facilitate communication between the experts devoted to its different branches.

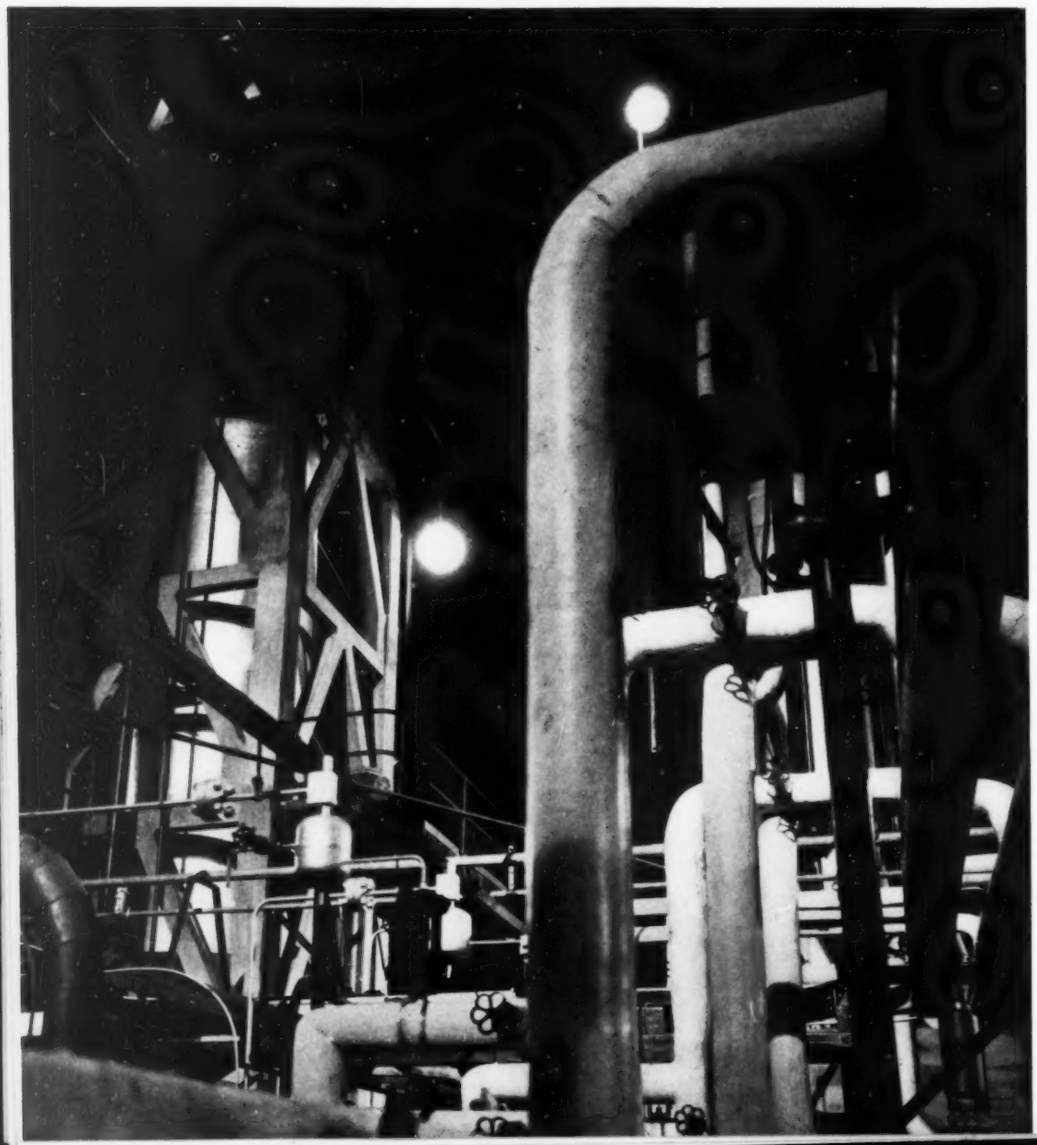
2) To promote the interchange of information between the persons devoted to the petroleum industry in all its aspects throughout South America, by means of permanent publications, booklets for interchange of opinions, by establishment of specialized libraries, diffusion of scientific films, lectures, etc.

3) To encourage and support any initiative tending towards the intensification of the commercial intercourse between the South American countries on the basis of petroleum and its allied products.

4) To encourage and support the study and adoption of South American standards for the petroleum industry.

5) To encourage intercourse and social ties between members of the Institute.

6) To act as intermediary in the pro-



Night view of ANCAP refinery at Montevideo where Carlos Vegh Garzon is general manager of the government's petroleum monopoly.

vision of experts in the different branches of the petroleum industry, for the government or enterprises needing them as well as to request services for the active members of the Institute.

I finally state that in the provisional by-laws now in course of preparation, my original proposition of admission of protecting members is being perfected, transforming them also into active members under the generic denomination of "corporations", including also governments, public and private institu-

(Continued on page 42)

Defiende Los Fines Del Instituto Sud Americano del Petroleo

Al Editor de World Petroleum:

En el número de "World Petroleum" correspondiente a noviembre de 1940, se ha dado a publicidad una comunicación de autor anónimo referente a mi proyecto de creación del Instituto Sudamericano del Petróleo, que apareció en el mes de septiembre en esa misma Revista.

El autor entra en una larga discusión sobre los inconvenientes que, a su juicio, presenta la política de nacionalización de las riquezas petrolíferas adoptada en algunos países sudamericanos; a esto me referiré en artículo, separado, ya que la importancia del tema tratado lo merece. El articulista formula tambien categóricas afirmaciones atribuyendo a mi referido proyecto un propósito determinado: el de orientar al futuro Instituto Sudamericano del Petróleo hacia una propaganda en favor de extensión de la propiedad del Estado sobre los yacimientos petrolíferos sudamericanos, y la consiguiente eliminación de las actividades industriales y comerciales de las empresas privadas en este continente.

Afirmo categóricamente que esa interpretación está absolutamente desprovista de fundamento. Como prueba de ello basta referirme a las conclusiones a que llegué en mi comunicación dirigida a la Unión Sudamericana de Asociaciones de Ingenieros con fecha 17 de Junio de 1940, en las cuales mencionaba precisamente como uno de los fundamentos del futuro instituto, la necesidad de vincular estrechamente a los técnicos sudamericanos, comprendiendo entre ellos a los Ingenieros y Químicos de la industria del petróleo en esta parte del continente, incluyéndose la explotación de yacimientos, la refinación de las materias primas de ellos extraídas y la comercialización de los productos elaborados; por consiguiente, están definitivamente incluídos en esta clasificación tanto los técnicos de industrias privadas como los de industrias estatizadas, como corresponde a un organismo que deberá ser esencialmente técnico y no político, ni en el aspecto económico, ni en el internacional.

La misma idea directriz, despojada de toda orientación política, se evidenciaba en mi proposición sobre admisión de los futuros miembros protectores del Instituto, entre los que yo incluía a las compañías particulares dedicadas a la explotación de la industria del petróleo, en sus tres ramas ya citadas, que ya existieran o que pudieran existir en el futuro en Sud América.

Por consiguiente, mis proposiciones originales que dejo resumidas deberían hacer-comprender al observador desapasionado que en el Instituto a crearse tendrían cabida todas las distintas manifestaciones de la industria petrolífera sudamericana, ya fueran aquellas que responden al predominio de la intervención fiscal como existe en algunos países (Argentina, Bolivia, Uruguay), ya las pertenecientes a la explotación particular predominante en otros (Venezuela, Colombia, Perú).

Lejos pues, de mí, toda idea de encasillar desde el original Instituto a crearse, dentro de determinada tendencia, ya que aun cuando la opinión personal del suscrito pueda ser favorable a una determinada, no podría nunca pretender detentar el monopolio de la sabiduría en este aspecto ni poseer por lo tanto el secreto de la solución ideal en un problema tan arduo que, merece la atención del mundo entero y conduce a polémicas y estudios nunca agotados.

Por la tanto, he considerado y continúo considerando que la adopción "a priori" de una orientación definida en un asunto tan delicado como es el de la política a desarrollarse económicamente en los países sudamericanos en materia de industria petrolera, haría que el nuevo organismo viniera a crearse con graves defectos que impedirían su amplio desarrollo que en otra forma le está asegurado.

Así lo entendió también el Directorio de la U. S. A. I., al prestar su apoyo a mi proyecto, y así acaba de ratificarlo el Comité Provisorio Organizador reunido recientemente en Buenos Aires, al resolver que, en los Estatutos Provisorios del Instituto a crearse, cuya redacción me ha sido encomendada, se fijaran las siguientes cláusulas para definir las finalidades perseguidas con su constitución:

1ª Fomentar y coordinar el estudio del petróleo en todas sus fases; es decir, las operaciones de explotación, industrialización y comercialización del petróleo y sus derivados en Sud América—por medio de intercambios o de informaciones, apoyando y financiando investigaciones, y facilitando la comunicación entre los técnicos ocupados en sus diversas ramas.

2ª Fomentar el intercambio de información entre las personas dedicadas a la industria del petróleo en todas sus fases en Sudamérica, por medio de publicaciones permanentes, folletos para intercambio de opiniones, creación de bibliotecas especializadas, intercambio de films científicos, conferencias, etc.

3ª Fomentar y apoyar toda iniciativa tendiente a intensificar el intercambio comercial entre los países sudamericanos sobre la base del petróleo y sus derivados.

4ª Propiciar y apoyar el estudio y adopción de normas sudamericanas de materiales para la industria del petróleo.

5ª Fomentar el acercamiento y vinculación social entre los miembros del Instituto.

6ª Servir de intermediario para suministro de técnicos especializados en las distintas ramas de la industria del petróleo, a aquellos Gobiernos o Empresas que así lo soliciten, así como también solicitar la prestación de servicios para los miembros activos del Instituto.

Por último, mencionaré que en los Estatutos actualmente en preparación, se ha perfeccionado mi primitiva proposición sobre admisión de miembros protectores, transformándolos también en miembros activos bajo la denominación genérica de "Corporaciones" en la que se admitirán a los gobiernos, instituciones públicas y privadas, y empresas privadas, quienes intervendrían en los trabajos y en la orientación del Instituto por intermedio de sus respectivos delegados.

Todo lo que dejo mencionado demuestra lo infundado de la crítica que tan ligeramente se ha pretendido formular sobre mi proyecto, desvirtuando los claros propósitos que me guiaron a someterlo a la consideración de mis colegas sudamericanos. El editor de World Petroleum al comentar editorialmente este asunto bajo el título "Function of a petroleum institute", en el mismo número de noviembre ppdo., expresa la inteligencia, basada en el proyecto publicado antes, de que el Instituto propuesto iba a ser modelado de acuerdo con los existentes en Europa y los Estados Unidos de Norte América, o sean el Instituto del Petróleo en Londres y el A. P. I. de Norte América, ya que todo propósito de política determinada no encajaría dentro de las actividades técnicas, científicas e industriales que deben ser los objetivos fundamentales de un Instituto de tal naturaleza.

Como lo dejo evidenciado más arriba, compartimos ampliamente estos conceptos, los que han sido ratificados por la prestigiosa institución que apoyó mi proyecto (U. S. A. I.) y por el Comité organizador que ha tomado a su cargo la redacción de los Estatutos provisorios del Instituto Sudamericano del Petróleo, siendo por lo tanto infundado todo lo que en sentido contrario pueda expresarse.

Carlos R. Vegh Garzon.

Montevideo, Diciembre 20 de 1940

tions and private concerns, all of them to participate in the work and orientation of the Institute through their respective representatives.

My above statements show the groundlessness of the criticism so rashly pronounced in respect of my plan, misrepresenting the sound purposes which led me to submit it to the consideration of my South American colleagues. The editor of WORLD PETROLEUM, in commenting this plan under the heading of "Function of a Petroleum Institute", in the same issue of November last, states the understanding based on the outline previously published that the proposed institute was to be modeled more or less on the institutes now existing in Europe and in the United States, such as the Institute of Petroleum in London, and the American Petroleum Institute in North America, as political objectives would not fit into the technical, scientifical and industrial activities which make up the principal aims of such an organization.

As I have already pointed out above, in this connection we fully converge in our tendencies, which have been ratified by the well-reputed institution which supported my plan (U. S. A. I.) and by the organization committee which has undertaken the wording of the provisional by-laws of the Instituto Sudamericano del Petróleo. Consequently, any other interpretation which might be given to my words would be groundless.

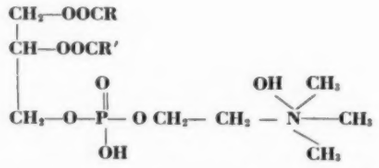
Carlos R. Vegh Garzon
MONTEVIDEO, DECEMBER 20, 1940.

Use of Lecithin in Gasoline

By H. V. Rees, W. S. Quimby, and J. C. D. Oosterhout
The Texas Co., New York, N. Y.

Paper presented to Division of Refining, before the Twenty-first Annual Meeting of the American Petroleum Institute, at the Stevens Hotel, Chicago, Ill., November 13, 1940.

LECITHIN is a fat-like yellow or brownish substance of plastic consistency occurring in all living cells, and is the best known of a group of complex compounds known as phosphatides. Its structure may be depicted as follows:



R represents an unsaturated fatty acid such as oleic, and R′ represents a saturated acid such as palmitic.

Lecithin forms colloidal solutions, and has found various applications as an interface modifier or emulsifier in the leather, textile, pigment, and food industries.

Until 1928 lecithin was derived wholly from animal sources, chiefly egg yolk, and was rather costly. Today lecithin is prepared commercially from soybeans by solvent extraction with hexane. Commercial soya lecithin includes other phosphatides, especially cephalin, and approximately 30 percent of residual oil, which imparts excellent storage and handling properties. It contains approximately 2.2 percent phosphorus; is soluble in benzol, chloroform, and petroleum ether; and is slightly soluble in alcohol, and is insoluble in acetone and water.

The use of lecithin in gasoline was brought about as the result of a comprehensive study of various additives in an attempt to reduce or prevent the deterioration of both leaded and unleaded gasoline upon exposure to sunlight. Practically every refiner has noted that exposure of his gasoline in pump bowls, even for relatively short periods, results in cloudiness and fading, with occasional formation of a whitish deposit. This cloudiness and deposit, due to the action of sunlight on the gasoline, is accelerated in leaded gasoline due to a gradual decomposition of the soluble tetraethyl lead to an insoluble compound believed to be lead triethyl hydroxide.

After the examination of a large number of additives for this purpose, lecithin was found to be the best material and was studied in great detail. The lecithin apparently acts as a peptizing agent, or protective colloid, in preventing the formation of a precipitate.

TABLE 1

Effect of Lecithin in Various Types of Gasolines

(All samples Contain 0.6 MI TEL* Per Gallon and Dye)

Sample No.	Gasoline Type	Treatment	Lecithin Dosage (Lb Per 1,000 Bbl)	Sunlight Exposure—Time for Cloud Formation: Without Lecithin (Minutes)	Sunlight Exposure—Time for Cloud Formation: With Lecithin (Hours)
1	Cracked	Doctor	15	40	12
2	Cracked	Acid; caustic; steam-still; doctor	15	45	16
3	Cracked	Acid; caustic; clay vapor-treated; doctor	15	40	5
4	Straight-run	Doctor	15	25	2¾
5	Blend 60 per cent No. 2, 40 per cent No. 4		15	45	12
6	Blend 60 per cent No. 3, 40 per cent No. 4		15	45	8

*Tetraethyl lead.

TABLE 2

Effect of Lecithin on Sunlight Stability (3-Hour Exposure) of Ethyl Fluid

	Identification	Cloud and Deposit Formation (Time in Hours): Clear For	Very Cloudy After	Deposit After	Color: Initial	Color: After 3 Hours
1	Sample 1 — Ethyl fluid	¼	½	½	Yellow	....
1	Sample 2 — Sample 1 +10 per cent lecithin	3+	....	....	Yellow	Slightly faded Yellow
2	Sample 7 — Same as sample 1					
2	Sample 8 — Same as sample 2					
2	Sample 9 — Sample 1 +5 percent alpha-naphthol	Black	....	18-hour settling	Yellow	Black
2	Sample 10 — Sample 1 +3 percent monobenzyl para aminophenol	Black	....	18-hour settling	Yellow	Black

SUNLIGHT

Samples of all types of leaded and dyed gasolines were exposed to direct sunlight in glass bottles, varying in size from one pint to five gallons, fitted with slotted cork stoppers. It was found that different gasolines reacted differently to this test, but in general all samples turned cloudy after an exposure of from a few minutes to several hours, followed by increasing cloudiness and the formation of a white deposit. The color of gasolines usually was affected detrimentally, as was the copper-dish gum and octane number.

The addition of lecithin to these gasolines prior to exposure results in a very marked improvement. The data indicated that lecithin retarded the deteriorating action of sunlight, but that the nature of this inhibiting action depended upon the nature of the gasoline, the effect being much less pronounced on straight-run gasoline than on cracked gasoline.

Samples of ethyl fluid also were exposed to direct sunlight in a similar manner to that mentioned above. Lecithin very materially improved the sunlight stability of ethyl fluid, and was the only one of a large number of compounds tried which had this effect.

Larger amounts of lecithin even further increased the sunlight stability, and higher dosages of TEL required additional quantities of lecithin for prevention of cloudiness.

Lecithin was found to have no effect on initial octane number or TEL susceptibility. Although a slight reduction in octane number through loss of light fractions during the sunlight-exposure test was found in all cases, very little additional octane loss was noted in samples which were only slightly cloudy over those which remained clear; but up to 12 octane numbers were lost on certain samples

TABLE 3

Effect of Lecithin on Sunlight Stability (3-Hour Exposure) of Leaded Gasoline

(All Samples Contain 1.5 Ml TEL Per Gallon and Dye)

Identification		Cloud and Deposit Formation (Time in Hours)			Color		Initial Copper-Dish Gum (Mg Per 100 Ml)	Initial ASTM Gum (Mg Per 100 Ml)
		Clear For	Very Cloudy After	Deposit Found After	Initial	After 3 Hours		
Sample 1	Doctor-sweetened cracked gasoline	½	Unreported	Unreported	Copper	Yellowish	77	4
Sample 2	Sample 1 + lecithin (15 lb per 1,000 bbl.)	3+	....	.....	Copper	Light copper	17	2
Fig. 1 Sample 3	Sample 1 + alpha-naphthol (30 lb per 1,000 bbl)	½	½	18-hour settling	Copper	Yellowish	16	5
Fig. 1 Sample 4	Sample 1 + alpha-naphthol (30 lb per 1,000 bbl) + lecithin (15 lb per 1,000 bbl)	8+	....	.....	Copper	Light copper	19	4
Fig. 1 Sample 5	Acid-treated, steam-stilled, and doctor-sweetened cracked gasoline	½	1	18-hour settling	Copper	Yellowish	4	3
Fig. 1 Sample 6	Sample 5 + lecithin (15 lb per 1,000 bbl)	3+	....	.....	Copper	Yellowish	8	2
Fig. 2 Sample 11	Acid-treated, steam-stilled, and doctor-sweetened cracked gasoline	½	1	18-hour settling	Copper	Yellowish	4	3
Fig. 2 Sample 12	Sample 11 + lecithin (15 lb per 1,000 bbl)	3+	....	.....	Copper	Yellowish	8	2
Fig. 2 Sample 13	Sample 11 + alpha-naphthol (15 lb per 1,000 bbl)	¼	½	18-hour settling	Copper	Yellowish	5	1
Fig. 2 Sample 14	Sample 11 + monobenzyl para aminophenol (15 lb per 1,000 bbl)	¼	½	18-hour settling	Copper	Yellowish	5	1
Sample 15	Sample 11 + alpha-naphthol (15 lb. per 1,000 bbl) + lecithin (15 lb per 1,000 bbl)	3+	....	.....	Copper	Yellowish	4	1
Sample 16	Sample 11 + monobenzyl para aminophenol (15 lb per 1,000 bbl) + lecithin (15 lb per 1,000 bbl)	3+	....	.....	Copper	Light copper	4	1
Sample 17	Doctor-sweetened straight-run gasoline	¼	¼	18-hour settling	Copper	Pink	7	1
Sample 18	Sample 17 + lecithin (15 lb per 1,000 bbl)	1½	2	18-hour settling	Copper	Pink	12	3
Sample 19	Sample 17 + lecithin (30 lb per 1,000 bbl)	3+	....	.....	Copper	Pink	....	....

which formed heavy cloud and deposits. This reduction in octane appears to be related to the amount of cloud formed, and for similar-type gasolines appears to be proportional to the amount of TEL present in the original samples.

The copper-dish-gum test (Atlantic Refining Company method) of the base gasoline before sunlight exposure was not affected materially by lecithin at values below 20 to 30 mg per 100 ml. In the majority of cases, an increase of less than 5 mg was noted in this range. At high copper-dish-gum values, above 70 to 100 mg per 100 ml, a reduction generally was noted. Lecithin, therefore, appears to inhibit TEL decomposition, and does not act as a strong gum inhibitor. After sunlight exposure, however, the base gasolines containing cracked components showed considerably increased copper-dish-gum values, but the action of lecithin was such as to minimize the detrimental effect of the exposure.

The effect of lecithin on the Saybolt color of the base gasoline before leading and dyeing was found to be negligible. The colors of the leaded samples after exposure, however, were found to vary from pink to yellow when using either red or copper-colored samples.

SULPHUR COMPOUNDS

The sunlight stability of leaded gasolines was noted to be related to their sulfur content. It was found that doctor sweetening, using a minimum amount of sulfur, resulted in slightly better sun tests, due to the formation of a minimum amount of polysulfides. Sweetening before steam stilling also resulted in lower sulfur-content stocks, with better sunlight stability, through a reduction in the amount of free and disulfide sulfur present, and rendered the gasoline much more susceptible to the stabilizing effect of lecithin.

A fundamental study of the effect of free sulfur, organic sulfides, and di- and polysulfides accordingly was conducted. Elementary sulfur acts as an accelerator of the action of sunlight in leaded gasoline. Inasmuch as the use of the usual copper-strip corrosion test or the Universal Oil Products Company butyl-mercaptan test limits free sulfur to a very small amount, little trouble should be experienced in this connection, provided the sweetening operation is controlled carefully.

Copper sweetening was investigated also, and gasolines so sweetened were found to have sunlight stabilities essentially equal to samples sweetened by the carefully controlled doctor method, and also were benefitted by the use of lecithin.

ORGANIC COMPOUNDS

An attempt was made to determine the reason why lecithin is so much more effective in retarding the effect of sunlight on cracked gasolines than on straight-run gasolines. It was believed that working with pure organic compounds might furnish some light on the matter.

Accordingly samples of *iso*octane, cyclohexane, and xylene were leaded with 0.8 ml of TEL per gallon and exposed to sunlight for two days. Lecithin affords protection in all three cases, but it is least effective with the *iso*paraffin tested.

As lecithin is derived from the choline ester of palmitic, stearic or oleic ester of glyceryl-phosphoric acid, its properties possibly might be due to one or more of these groups. There-

Laboratory on Long Island where the use of lecithin is under constant study.

TABLE 4

Effect of Steam Stilling, before Doctor Sweetening, on Lecithin Susceptibility

(All Samples Contain 0.8 Ml TEL Per Gallon)

Sample No.	Gasoline Type	Treatment	Lecithin Dosage (Lb. Per 1,000 Bbl)	Sulfur Content (Percent)	Sunlight-Exposure Time for Cloud Formation		Color	
					Without Lecithin (Hours)	With Lecithin (Hours)	Initial	After 8 Hours
1	Straight-run	Caustic; acid; caustic; doctor; steam-still and doctor	15	0.107	½	8	Copper	Pale copper
2	Straight-run	Caustic; acid; caustic; steamstill and doctor	15	0.253	¼	3½	Copper	Pink

TABLE 5

Effect of Sulfur Compounds on Sunlight Stability

(All Samples Contain 0.8 MITEL Per Gallon and Dye)

Sample No.	Gasoline Tupe	Treatment	Lecithin Dosage (Lb. Per 1,000 Bbl)	Sunlight-Exposure Time for Cloud Formation		Color	
				Without Lecithin (Hours)	With Lecithin (Hours)	Initial	After 24-Hour Sun Test
1	Straight-run	Doctor	15	¾	2½	Copper	Pale salmon
2	Sample 1+0.015 percent ethyl disulfide	.....	15	¾	2½	Copper	Pale salmon
3	Sample 1+0.015 percent butyl sulfide	.....	15	¾	2½	Copper	Pale salmon
4	Straight-run	Doctor	15	½	2½	Copper	Pale salmon
5	Sample 4+0.005 percent sulfur	.....	15	½	2	Copper	Pale salmon
6	Sample 4+0. 010 percent sulfur	.....	15	¾	2	Copper	Pale salmon
7	Sample 4+0. 010 percent sulfur +0.2 percent ethyl disulfide	.....	15	¼	1½	Copper	Pale salmon
8	Blend 60 percent cracked and 40 percent straight-run	Doctor	15	1	24+	Copper	Bleached
9	Sample 8+0. 002 percent sulfur	.....	15	¾	8	Copper	Bleached
10	Sample 3+0 .01 percent sulfur	.....	15	¾	2½	Copper	Bleached
11	Sample 8+0.02 percent sulfur	.....	15	¼	2	Copper	Bleached
12	Sample 8+0.07 percent ethyl disulfide	.....	15	1	8	Copper	Blrached

fore, samples of choline and oleic, palmitic and glycerylphosphoric acid were tested separately for their effect on sun stability of leaded gasoline, without success. Lecithin alone appears to have the unusual property of stabilizing gasoline in this respect.

COMBINATIONS

During the course of this investigation, it was noted that certain gasolines required the use of an auxiliary agent with lecithin to effect the desired stability. Several anti-oxidants were tried, and it was noted that products such as monobenzyl para aminophenol, alphanaphthol, catechol, and pyrogallol, which in themselves had no stabilizing effect on cloud or deposit formation in sunlight, improved the light-stabilizing properties of lecithin. Certain of these inhibitors, viz., pyrogallol and monobenzyl para aminophenol, resulted in impaired colors after sunlight exposure; whereas commercial phenol, having a relatively poor gum-inhibiting tendency, often bleached the original color. It was found that a combination of these strong gum inhibitors with commercial phenol and lecithin greatly improved the sunlight stability of leaded gasolines from the standpoint of cloud formation and color change. Similar results on unleaded gasolines by the use of aromatic ring compounds, such as alphanaphthol or anthracene, were obtained.

ACCELERATED-GUM TEST

In addition to the effects previously reported, it was found that lecithin was a valuable additive for the stabilization of the accelerated-gum test (Army method) in aviation gasolines. Data covering the stability of typical leaded aviation gasolines indicates that the accelerated-gum content of gasolines which tends to increase on storage may be stabilized by the use of lecithin.

In order to determine whether lecithin lost its inhibiting effect on prolonged storage in closed dark containers, samples of various types of gasolines were stored with and without lecithin, both dry and over water, for a period of one year, and tested for sunlight stability. The results obtained in all cases indicated that lecithin was as effective in the stored samples as it had been initially.

After several years of full-scale refinery production of gasolines containing lecithin,

TABLE 6

Effects of Lecithin on Pure Leaded Organic Compounds Containing 0.8 Ml TEL Per Gallon

Compound	Lecithin Dosage (Lb. Per 1,000 Bbl)	Sunlight-Exposure Time for Cloud Formation	
		Without Lecithin (Hours)	With Lecithin (Hours)
Isooctane	15	1	5
Cyclohexane	15	1	48+
Xylene	15	1	48+

TABLE 7

Effect of Combinations of Lecithin with Other Inhibitors

(All Samples Contain 0.8 Ml TEL Per Gallon)

Sample	Gasoline Type	Treatment	Lecithin Dosage (Lb Per 1,000 Bbl)	Sunlight-Exposure Time for Cloud Formation		Color	
				Without Lecithin (Hours)	With Lecithin (Hours)	Initial	After 24 Hours
1	Blend 70 percent straight-run and 30 percent cracked	Acid; caustic; doctor; steam-still; doctor	15	¼	1½	Copper	Pale salmon
2	Sample 1+7 lb per 1,000 bbl monobenzyl para aminophenol +0.02 percent cresylic acid		15	¼	23	Copper	Copper
3	Straight-run	Doctor	10	½	3½	Copper	Pale salmon
4	Sample 3+7 lb. per 1,000 bbl monobenzyl para aminophenol +0.02 percent cresylic acid		10	½	24+	Copper	Copper
5	Cracked	Acid; caustic; doctor; steam-still; doctor	5	1½	4	Copper	Yellowish
6	Sample 5+7 lb per 1,000 monobenzyl para aminophenol +0.02 percent cresylic acid		5	1½	24+	Copper	Copper

TABLE 8

Effect of Combinations of Lecithin with Other Inhibitors

(All Samples Contain No TEL)

Sample No.	Gasoline Type	Treatment	Lecithin Dosage (Lb. Per 1,000 Bbl.)	Sunlight-Exposure Time for Cloud Formation	
				Without Lecithin (Hours)	With Lecithin (Hours)
1	Straight-run	Doctor	5	½	4
2	Sample 1 + alpha-naphthol (10 lb per 1,000 bbl)		5	½	18+
3	Blended, cracked, and straight-run	Acid; caustic; steam-still and doctor	10	½	5
4	Sample 3 + anthracene (5 lb per 1,000 bbl)		10	4	12
5	Sample 3 + anthracene (10 lb per 1,000 bbl)		10	4	18+

examinations of engines using lecithin-treated gasolines did not reveal any deleterious effects and it appears entirely harmless.

CORROSION

A separate and distinct function of lecithin was noted during the course of the previously reported work. This was its effect on the prevention of corrosion of iron and galvanized iron containers by both unleaded and leaded gasolines.

It has been known for years that leaded gasoline was very slightly corrosive to tanks and drums used for its storage. With the rapid increase in the use of highly leaded gasoline in recent years, the problem became more acute, because the degree of corrosion appeared to be linear with the amount of TEL present, and particularly so as the presence of water aggravated this corrosion. It is common practice to use water as a seal in the bottom of large storage tanks, and means of combating this corrosion are of importance.

The reason for this increased corrosion of iron and galvanized iron by leaded gasoline in the presence of water is not known definitely, but is indicated to be due to the presence of free bromine or chlorine liberated from the ethylene dibromide and ethylene dichloride present in the TEL fluid to reduce lead deposits in the engine, after combustion. These halides probably combine with the water present to form corrosive hydrobromic or hydrochloric acid.

Inasmuch as lecithin already had been found to prevent deterioration of TEL fluid alone, its effect on the corrosion problem was investigated. Samples of unleaded and leaded gasoline with and without lecithin were stored, both dry and over water, to observe the corrosive effect on small strips of carefully cleaned iron and galvanized iron in stoppered glass bottles. After one year, examination of the strips indicated:

1. In the absence of water, all strips were free of corrosion.
2. In the presence of water and unleaded gasoline, all strips were corroded considerably, particularly that part of the strip which had been immersed in the water. The corrosive effect of the water was more pronounced in leaded gasoline.
3. The alkalinity of the water appeared to reduce the corrosion of leaded gasoline, as greatest corrosion was found in the presence of distilled water.
4. The use of lecithin, amounting to 5 lb. to 10 lb. per 1,000 bbl. in leaded gasoline greatly reduced the corrosion of both iron and galvanized iron

These tests were followed by actual storage in iron and galvanized-iron drums, and the results were found to agree closely with those reported hereinbefore. Observation of a large number of storage tanks over a period of years confirmed the fact that leaded gasoline was more corrosive than unleaded gasoline, and that its corrosive effect could be remedied by the use of lecithin.

Considerable trouble has been encountered by petroleum marketers in preventing the formation of zinc oxide in galvanized-iron drums containing leaded gasoline. On quiescent storage this material tends to settle to the bottom of drums, but is dispersed readily throughout the drums during movement. In aviation gasoline, particularly, such a deposit is highly objectionable, and commercial air lines go to extreme measures to prevent this material from entering their fuel tanks. Filtration through chamois sometimes is resorted to, but is extremely slow if much zinc oxide is present.

Although especially processed containers can be obtained, this is relatively expensive, and should be avoided if a cheaper and dependable gasoline treatment can be found. Lecithin was tried in this connection and found to be extremely effective in eliminating this formation of zinc oxide in the absence of water, and in materially reducing it in the presence of water when used in dosages of 5 lb. to 15 lb. per 1,000 bbl.

It has been noted also that leaded aviation gasoline, particularly, sometimes was decolorized or changed from blue to pale green by the action of the lead on the galvanized drums in the presence of water. This decolorization also was found to be practically eliminated by the use of lecithin.

ALUMINUM

With the adoption of increased tetraethyl lead in aviation gasoline, it developed that certain commercial air lines were experiencing considerable difficulty with the corrosion of aluminum fuel-tank bottoms. The cause was believed to be the condensation of moisture from the air drawn into the tanks as the fuel was consumed.

It was found, by actual observation, that aviation gasolines containing lecithin were relatively free of this corrosion under service conditions, and a laboratory investigation was conducted to verify this effect. Available data show that the presence of either TEL fluid or ethylene dibromide causes considerable corrosion of aluminum in the presence of water, and that this corrosion largely can be eliminated by the use of lecithin.

COST

Each refiner and each gasoline will require a different amount of lecithin to effect the results set forth herein, depending upon the susceptibility of the gasoline to lecithin and upon the desired storage stability. With dosages ranging from 1 lb. to 15 lb. per 1,000 bbl. of gasoline, the cost of lecithin stabilization ranges from $0.0004 to $0.0056 per barrel.

CONCLUSIONS

As a result of these investigations, it is concluded that lecithin is effective in improving the quality of gasoline without any detrimental effects, and allows the refiner to improve his products along lines demanded by the high-octane leaded fuels of today at a minimum of expense. In addition, tankage and drum-maintenance expense is lessened due to reduced corrosion. Furthermore, it furnishes the farmer another outlet for farm products, i.e., in the petroleum industry.

TABLE 9

Effect of Lecithin on Accelerated-Gum Test (Army Method)

(All Samples Contain 4 Ml TEL Per Gallon)

Sample No.	Gasoline Type	Accelerated Gum (Mg Per 100 Ml)					
		Initial		One Month		Two Months	
		Without Lecithin	With Lecithin*	Without Lecithin	With Lecithin*	Without Lecithin	With Lecithin*
1	Straight-run aviation	2	1	3	3	5	1
2	Blended aviation 60 percent sample 1 40 percent *isooctane*	3	1	25	4	45	6
3	Blended aviation 50 percent sample 1 50 percent alkylation gasoline	4	4	37	3	40	6

*10 lb per 1,000 bbl lecithin added.

WORLD OIL

Figures in U. S. barrels of 42 [illegible]—Co[illegible]

U. S. BARRELS

	Dec. 1939	Jan. 1940	Feb. 1940	March 1940	April 1940	May 1940	June 1940	July 1940	August 1940	Sept. 1940	Oct. 1940	Preliminary Figures Nov. 1940
United States	115,120,000	113,140,700	108,668,800	120,075,000	116,046,000	118,283,000	111,690,000	113,244,000	110,523,000	109,337,000	113,418,000	110,036,050
Soviet Union	18,406,932	18,406.932	17,251,723	18,454,796	17,896,740	18,448,875	18,250,000	18,450,000	18,500,000	18,500,000	18,500,000	18,500,000
Venezuela	16,050,535	14,798,667	14,380,134	15,514,962	16,495,995	18,343,406	18,629,609	16,580,129	15,134,616	14,623,146	13,828,100	13,192,632
Iran	6,637,503	6,637,503	6,227,895	6,745,073	6,507,180	6,560,000	6,449,520	6,664,504	6,700,000	6,700,000	6,700,000	6,700,000
Netherland India: Sumatra	3,629,655	3,472,786	3,149,536	3,440,792	3,428,880	3,456,624	3,345,120	3,456,624	3,456,624	3,345,000	3,345,000	3,345,000
Borneo	1,086,713	1,093,743	1,062,210	1,097,516	1,063,890	1,106,080	1,070,400	1,106,080	1,106,080	1,070,400	1,070,400	1,070,400
Java	633,136	561,064	507,207	562,665	537,720	555,582	537,660	555,582	555,582	537,600	537,600	537,600
Molucca and Other	60,550	59,215	62,340	54,021	67,740	62,310	60,300	62,310	62,310	60,300	60,300	60,300
Rumania	3,842,154	3,786,908	3,595,888	3,818,554	4,422,721	3,830,236	3,682,618	3,812,557	3,864,721	3,253,201	3,063,725	3,000,000
Mexico	3,500,000	3,348,682	3,147,385	3,286,000	3,180,000	3,412,080	3,873,720	2,945,000	3,410,000	3,400,000	3,472,000	3,400,000
Iraq	2,615,129	2,615,129	2,461,723	2,666,713	2,578,020	2,644,362	2,559,060	2,200,000	2,000,000	1,500,000	1,500,000	1,500,000
Colombia	1,871,594	2,484,398	2,025,618	2,203,272	2,192,178	2,427,000	2,200,000	2,200,000	2,200,000	2,000,000	2,000,000	2,000,000
Trinidad	1,636,645	1,636,645	1,529,808	1,633,421	1,580,940	1,634,754	1,659,000	1,684,000	1,710,000	1,750,000	1,800,000	1,800,000
Argentine	1,691,123	1,671,378	1,535,460	1,682,029	1,616,171	1,684,641	1,677,338	1,762,206	1,746,543	1,785,000	1,875,500	1,830,000
Peru	1,154,037	1,154,037	1,071,869	1,139,932	1,097,400	1,143,466	1,106,580	1,143,466	1,143,466	1,106,600	1,106,600	1,106,600
Bahrein	632,962	631,644	581,255	636,577	579,078	616,174	602,560	620,486	622,443	598,924	621,077	600,990
Burma	708,054	666,810	629,039	689,750	666,810	679,520	657,600	679,520	679,520	657,600	657,600	657,600
Canada	502,920	486,859	655,586	570,131	634,869	676,486	657,098	877,133	868,651	841,752	817,596	893,438
Brunei	488,777	488,777	456,576	487,661	471,540	487,940	472,200	487,940	487,940	472,200	472,200	472,200
Great Germany: Old Reich	381,114	381,114	360,383	386,508	371,610	384,183	371,790	384,183	384,183	380,000	380,000	380,000
Ostmark	58,869	58,869	57,072	61,721	61,230	61,194	59,220	61,194	61,194	59,200	59,200	59,200
Slovakia and Moravia	10,137	10,137	9,454	10,106	9,780	10,106	9,780	10,106	10,106	9,800	9,800	9,800
Poland	331,049	331,049	310,155	331,669	320,790	331,421	320,730	331,421	331,421	320,700	320,700	320,700
Japan	223,960	225,308	210,801	224,068	216,960	224,719	217,470	224,719	224,719	217,470	217,470	217,470
British India	228,281	197,532	180,351	189,999	180,090	191,611	185,430	191,611	191,611	185,400	185,400	185,400
Ecuador	205,138	204,509	188,024	211,610	208,513	213,000	201,650	207,700	210,676	208,399	226,142	160,775
Saudi Arabia	437,020	491,663	323,416	606,201	476,359	334,728	356,571	478,243	425,829	467,900	467,900	467,900
Sarawak	112,716	112,716	104,951	112,282	108,330	112,282	108,660	112,282	112,282	108,700	108,700	108,000
Egypt	446,846	438,367	376,043	432,729	454,260	435,891	421,830	450,000	450,000	425,000	425,000	420,000
Italian Empire: Albania	118,358	118,358	112,230	123,411	119,250	121,241	117,330	121,241	121,241	117,300	117,300	117,300
Italy	7,000	6,650	6,000	5,500	5,000	5,000	4,400	4,400	4,400	4,000	4,000	4,000
France	42,532	42,532	39,817	42,439	41,100	42,470	41,100	42,470	42,470	41,100	41,000	40,000
Hungary	85,000	90,000	100,000	110,000	120,000	135,000	150,000	160,000	170,000	180,000	180,000	180,000
Bolivia	8,556	8,556	7,975	8,587	8,310	9,000	9,500	8,556	10,000	10,000	10,000	10,000
Other Countries	49,073	49,073	45,849	49,786	48,150	49,383	47,790	49,383	49,383	47,800	47,800	47,800
WORLD TOTAL	182,391,068	179,908,310	171,432,573	187,664,309	183,713,604	188,713,241	181,803,134	181,369,990	177,571,011	174,321,492	177,646,110	173,431,155

Where official figures are unobtainable because of existing conditions estimates based on best available private information are given.

Daily Averages in Barrels

	Jan.—November 1940	1939
United States	3,714,810	3,442,640
Soviet Union	600,474	593,772
Venezuela	512,004	568,063
Iran	216,691	214,113
Netherland India: Sumatra	111,170	113,441
Borneo	35,573	35,782
Java	17,868	17,708
Molucca and Other	2,004	2,311
Rumania	119,794	126,017
Mexico	110,073	107,569
Iraq	72,313	84,395
Colombia	71,440	60,374
Trinidad	54,980	52,795
Argentine	56,317	50,731
Peru	36,776	37,227
Bahrein	20,033	21,051
Burma	21,854	20,510
Canada	24,118	21,959
Brunei	15,693	15,807
Great Germany: Old Reich	12,429	12,294
Ostmark	1,968	1,899
Slovakia and Moravia	326	327
Poland	10,658	10,679
Japan	7,227	7,270
British India	6,162	6,065
Ecuador	6,689	6,308
Saudi Arabia	14,617	10,232
Sarawak	3,611	3,646
Egypt	14,116	12,232
Italian Empire: Albania	3,899	3,807
Italy	159	250
France	1,362	1,372
Hungary	4,701	2,136
Bolivia	299	276
Other Countries	1,588	1,583
WORLD TOTAL	5,903,208	5,666,620

Official Crude Oil Production Figures for 1933 to 1939 (Revised) in Barrels

	1939	1938	1937	1936	1935	1934	1933
United States	1,264,962,000	1,214,355,000	1,279,160,000	1,098,516,000	996,596,000	908,065,000	905,656,000
Soviet Union	216,727,024	206,192,000	201,856,661	199,635,921	184,008,033	175,635,783	155,596,429
Venezuela	205,783,585	188,429,050	187,675,477	155,270,840	148,809,057	136,098,681	117,113,940
Iran	78,151,332	78,320,840	78,109,001	62,977,950	57,520,488	57,902,092	54,440,075
Netherland India: Sumatra	41,557,020	34,538,128	33,451,511	30,469,428	28,004,595	26,336,011	22,345,172
Borneo	13,125,425	12,812,383	12,960,072	13,068,910	13,529,185	14,335,543	15,003,175
Java	6,568,660	6,955,283	7,152,931	3,618,293	3,462,440	3,778,920	3,600,816
Molucca and Other	836,144	607,622	537,436	375,823	311,872	273,698	285,335
Rumania	46,020,000	48,366,000	52,395,725	63,532,846	61,270,072	61,849,306	53,919,708
Mexico	39,428,141	38,505,824	46,455,687	41,027,915	40,240,563	38,171,946	34,000,830
Iraq	30,791,132	32,404,000	30,603,660	29,913,150	27,410,983	7,639,84	1,094,915
Colombia	22,036,613	21,581,588	20,297,543	18,756,110	17,597,655	17,337,900	13,156,126
Trinidad	19,270,256	17,736,176	15,502,989	13,237,030	11,671,224	10,894,363	9,561,353
Argentine	18,613,167	17,076,237	16,354,717	15,457,960	14,297,025	14,021,901	13,690,556
Peru	13,587,906	15,908,279	17,459,112	17,593,069	17,056,555	16,314,381	13,257,318
Bahrein	7,588,554	8,297,998	7,762,264	4,644,635	1,264,807	285,072	31,377
Burma	7,872,981	7,499,498	7,847,553	7,587,718	7,181,113	7,278,859	7,114,311
Canada	7,837,503	6,965,457	2,996,033	1,507,931	1,447,204	1,410,895	1,145,333
Brunei	5,755,164	5,387,214	4,397,038	3,296,938	3,302,905	2,705,350	2,035,656
Great Germany: Old Reich	4,487,491	3,850,044	3,148,300	3,076,858	2,967,438	2,204,402	1,656,602
Ostmark	693,247	370,038	221,266	50,092	44,347	27,965	5,765
Slovakia and Moravia	119,380	132,005	123,474	126,603	136,580	177,797	121,695
Poland	3,898,044	3,828,438	3,799,862	3,869,575	3,901,881	4,011,336	4,174,079
Japan	2,652,930	2,511,184	2,487,841	2,403,072	2,294,878	1,872,837	1,504,412
British India	2,332,467	2,330,209	2,161,653	1,978,329	2,037,810	1,921,863	1,628,803
Ecuador	2,312,118	2,257,278	2,161,436	1,942,467	1,731,785	1,636,619	1,619,902
Saudi Arabia	3,933,904	495,135	64,968	19,777	Nil	Nil	Nil
Sarawak	1,327,327	1,624,882	1,655,565	1,547,882	1,776,593	1,942,591	2,206,815
Egypt	4,602,797	1,561,231	1,163,267	1,262,666	1,255,151	1,527,252	1,653,535
Italian Empire: Albania	1,393,727	437,597	380,292	219,693	41,218	17,500	11,437
Italy	91,330	106,083	112,700	129,653	128,615	162,449	213,534
France	500,815	516,240	507,067	534,063	529,664	700,000	786,366
Hungary	769,092	330,829	13,910	100	Nil	Nil	Nil
Bolivia	100,885	106,620	123,123	104,746	163,295	157,875	111,973
Other Countries	578,036	243,000	70,000	37,100	32,300	64,000	54,100
WORLD TOTAL	2,076,306,197	1,982,639,390	2,041,170,134	1,797,791,150	1,652,023,331	1,516,760,036	1,438,797,443

PRODUCTION

—Conversion ratios used are weighted averages for individual countries

METRIC TONS

	Dec. 1939	Jan. 1940	Feb. 1940	March 1940	April 1940	May 1940	June 1940	July 1940	August 1940	Sept. 1940	Oct. 1940	Preliminary Figures Nov. 1940
United States	15,575,700	15,307,901	14,702,854	16,246,164	15,700,987	16,003,653	15,111,622	15,321,877	14,953,727	14,793,266	15,345,420	14,887,843
Soviet Union	2,508,024	2,508,024	2,360,194	2,531,522	2,436,780	2,520,083	2,503,429	2,530,864	2,537,722	2,537,722	2,537,720	2,537,720
Venezuela	2,383,153	2,197,278	2,135,135	2,303,632	2,449,294	2,723,594	2,766,089	2,461,786	2,247,159	2,171,217	2,053,170	1,958,817
Iran	880,493	880,493	826,152	894,753	863,190	870,212	855,540	884,058	888,784	888,784	888,785	888,785
Netherland India: Sumatra	464,685	444,602	403,218	440,506	438,960	432,525	426,270	440,479	440,479	426,270	426,300	426,300
Borneo	139,126	140,026	135,989	140,509	136,290	141,608	137,040	141,608	141,608	137,040	137,000	137,000
Java	81,057	71,830	64,935	72,035	68,820	71,114	69,210	71,114	71,114	69,210	69,200	69,200
Molucca and Other	7,752	7,581	7,981	6,916	8,670	7,967	7,710	7,967	7,967	7,710	7,700	7,700
Rumania	520,970	513,479	487,578	517,770	599,691	519,354	499,338	516,957	524,030	441,112	415,420	406,779
Mexico	513,950	492,094	462,171	482,525	466,960	501,028	491,923	432,452	500,734	499,265	509,838	499,266
Iraq	349,556	349,556	330,034	356,531	344,670	353,741	342,330	294,000	267,000	200,000	200,000	200,000
Colombia	260,524	346,499	282,512	307,290	305,745	338,493	306,834	306,834	306,834	278,940	278,940	278,940
Trinidad	230,206	230,206	215,151	229,710	222,360	229,896	233,300	236,800	240,000	246,000	253,165	253,165
Argentine	240,900	238,088	218,726	239,605	230,223	239,977	238,937	251,026	248,795	254,273	267,094	260,683
Peru	152,737	152,737	141,810	150,784	145,200	151,280	146,400	151,280	151,280	146,400	146,400	146,400
Bahrein	86,375	86,195	79,319	87,017	79,022	84,084	82,227	84,673	84,940	81,730	84,754	82,012
Burma	97,797	92,101	86,855	94,147	91,980	93,527	90,510	93,527	93,527	90,510	90,500	90,500
Canada	64,001	61,957	83,429	72,554	80,792	86,088	83,621	111,619	110,543	107,120	104,046	113,697
Brunei	65,193	65,193	60,900	65,038	62,880	65,069	62,970	65,038	65,038	62,970	62,970	62,970
Great Germany: Old Reich	54,963	54,963	51,997	55,800	53,940	55,490	53,700	55,490	55,490	53,700	54,340	54,340
Ostmark	9,331	9,331	9,048	9,827	9,780	9,703	9,390	9,703	9,703	9,390	9,390	9,390
Slovakia and Moravia	1,519	1,519	1,421	1,519	1,470	1,519	1,470	1,519	1,519	1,470	1,470	1,470
Poland	44,392	44,392	41,644	44,516	43,050	44,454	43,020	44,454	44,454	43,000	43,000	43,000
Japan	31,857	32,178	30,131	32,023	31,020	32,085	31,050	32,085	32,085	31,000	31,000	31,000
British India	31,530	27,280	24,911	26,226	24,870	26 443	25,590	26,443	26,443	25,590	25,600	25,600
Ecuador	27,045	26,962	24,788	27,898	27,490	28 081	26,585	27,382	27,775	27,475	29,814	21,196
Saudi Arabia	59,201	66,604	43,812	82,120	64,531	45,344	48,304	64,785	57,685	63,400	63,400	63,400
Sarawak	14,539	14,539[1]	13,543	14,415	13,920	14,446	13,980	14,446	14,446	14,000	14,000	13,370
Egypt	63,817	62,606	53,534	58,125	57,150	59,272	57,360	64,267	64,267	60,696	60,696	59,982
Italian Empire: Albania	17,670	17,670	16,762	18,415	17,790	18,073	17,790	18,073	18,104	17,790	17,790	17,790
Italy	870	820	750	680	620	620	540	540	540	500	500	500
France	5,952	5,952	5,568	5,952	5,760	5,952	5,760	5,952	5,952	5,760	5,760	5,610
Hungary	11,435	12,100	13,450	14,800	16,140	18,160	20,180	21,525	22,870	24,200	24,200	24,200
Bolivia	992	992	928	992	960	992	1,166	1,231	1,394	1,394	1,400	1,400
Other Countries	6,975	6,975	6,525	7,006	6,780	7,223	6,810	7.223	7,037	6,800	6,800	6.800
WORLD TOTAL	25,004,287	24,570,723	23,423,755	25,639,322	25,107,785	25,801,150	24,817,915	24,799,077	24,271,045	23,825,704	24,267,582	23,686,825

Daily Averages in Metric Tons

	Jan.—November 1940	1939
United States	502,612	465,792
Soviet Union	82,214	80,904
Venezuela	76,021	83,350
Iran	28,744	28,427
Netherland India: Sumatra	14,166	14,529
Borneo	4,554	4,600
Java	2,291	2,275
Molucca and Other	257	298
Rumania	16,243	17,087
Mexico	15,935	15,808
Iraq	9,665	11,276
Colombia	9,963	8,404
Trinidad	7,730	7,426
Argentine	8,022	7,188
Peru	4,865	4,927
Bahrein	2,734	2,901
Burma	3,008	2,798
Canada	3,031	2,794
Brunei	2,092	2,105
Great Germany: Old Reich	1,788	1,774
Ostmark	313	301
Slovakia and Moravia	49	49
Poland	1,429	1,432
Japan	1,031	1,039
British India	850	818
Ecuador	882	837
Saudi Arabia	1,980	1,396
Sarawak	464	469
Egypt	1,966	1,727
Italian Empire: Albania	585	569
Italy	20	31
France	190	192
Hungary	632	284
Bolivia	38	33
Other Countries	227	224
WORLD TOTAL	806,599	774,000

Official Crude Oil Production Figures for 1933 to 1939 (Revised) in Metric Tons

	1939	1938	1937	1936	1935	1934	1933
United States	171,148,965	164,346,325	172,822,797	148,707,864	134,912,143	122,913,903	122,601,191
Soviet Union	29,530,168	28,859,000	27,867,025‡	27,384,900	25,241,100	24,092,700	21,330,100
Venezuela	30,533,706	27,845,286	27,733,926	22,945,299	21,990,373	20,112,115	17,293,193
Iran	10,367,112	10,358,495	10,330,480	8,329,289	7,607,500	7,657,970	7,200,093
Netherland India: Sumatra	5,320,320	4,662,836	4,490,137	4,114,710	3,759,006	3,535,035	2,999,352
Borneo	1,680,377	1,719,783	1,739,607	1,773,545	1,815,998	1,924,234	2,013,849
Java	840,950	933,595	960,125	499,097	464,757	510 320	483,331
Molucca and Other	107,047	81,560	72.139	50,446	41,862	36 738	38,300
Rumania	6,240,000	6,603,000	7,153,000	8,704,000	8,394,000	8,473,355	7,387,000
Mexico	5,794,215	5,716,423	6,896,657	6,090,842	5,973,955	5,666,857	5,849,109
Iraq	4,115,845	4,345,000	4,126,185	4,079,066	3,724,231	1,048,108	147,943
Colombia	3,067,568	3,007,935	2,844,251	2,614,092	2,452,635	2,416,432	1,833,606
Trinidad	2,710,515	2,472,943	2,181,676	1,862,796	1,642,446	1,533,122	1,345,532
Argentina	2,651,448	2,432,857	2,330,063	2,202,304	2,036,903	1,997,706	1,950,499
Peru	1,798,557	9,099,885	2,313,691	2,331,454	2,260,903	2,161,990	1,756,867
Bahrein	1,033,472	1,130,734	1,058,557	635,555	173,072	39,008	4,293
Burma	1,087,424	1,039,960	1,083,391	1,047,593	991,456	1,004,951	982,233
Canada	997,391	879,921	378,478	190,495	182,820	178,233	144,686
Brunei	767,700	707,123	576,545	470,991	471,842	386,478	290,808
Great Germany: Old Reich	647,337	552,074	453,451	444,600	427,400	317,500	238,600
Ostmark	109,904	63,468	33,010	7,473	6,616	4,172	860
Slovakia and Moravia	18,103	19,282	18,036	18,665	19,946	25,971	17,776
Poland	522,874	504,678	501,301	510,630	614,760	529,200	550,670
Japan	379,161	356,328	341,040	341,976	326,580	266,520	212,667
British India	322,160	322,125	298,450	273,137	281,072	265,341	224,879
Ecuador	306,824	319,877	306,326	275,293	245,434	231,947	229,578
Saudi Arabia	536,366	66,683	8,070	2,447	Nil	Nil	Nil
Sarawak	171,322	200,126	217,085	221,126	253,799	277,513	315,259
Egypt	657,510	223,058	166,298	177,491	176,436	214,671	232,437
Italian Empire: Albania	208,279	65,313	56,760	32,760	6,152	2,500	1,707
Italy	11,346	13,178	14,000	16,106	15,977	20,180	26,526
France	70,224	72,106	71,008	74,788	74,172	98,025	110,120
Hungary	103,364	42,798	13,910	13	Nil	Nil	Nil
Bolivia	11,904	13,262	15,487	13,197	20,540	19,858	14,085
Other Countries	82,300	34,080	10,000	5,300	4,600	9,100	7,700
WORLD TOTAL	283,951,758	279,111,097	279,482,962	246,449,340	226,610,486	207,971,753	197,034,849

Foreign Oil Legion

J. C. VAN ECK, joint managing director of the Royal Dutch Shell group, who left London in July last for an extended business trip to Netherlands India, recently returned to the United States by way of California and is spending some time in New York.

Dr. Daniel Amadeo y Videla

IN THE recent reorganization of the Argentine cabinet the 49-year old Dr. Daniel Amadeo y Videla succeeds Dr. Cosme Massini Ezcurra as Minister of Agriculture. (In Argentina the Minister of Agriculture has general jurisdiction over the petroleum industry and especially the petroleum enterprises owned and operated by the government). The new Minister was born in Buenos Aires and majored in law and the social sciences at the national university. He has been a member of the Chamber of Deputies, and has occupied several important posts in the agricultural department. His parliamentary posts have included chairmanships of committees investigating labor problems and agricultural social security, and he has published numerous articles on the agricultural problems of the nation. He has announced that he will continue the traditional policy of the government in petroleum matters.

Phillip M. Robinson

© Cosmo-Silco

Mr. and Mrs. G. J. Ossentojuk, of the legal department, Caribbean Petroleum Company in Maracaibo, Venezuela, sailing from New York, December 13, on the Santa Rosa for a three year stay in Venezuela.

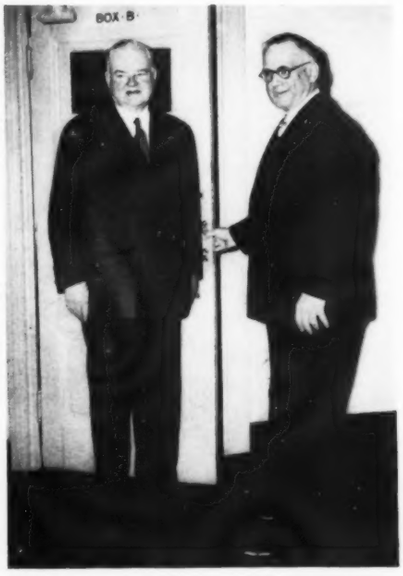
CONSIDERATIONS of health and the necessity of taking an extended rest have led to the resignation of R. BEAUMONT as Director of Trinidad Leaseholds Ltd. after twenty years in the service of the company. MR. E. D. A. HERBERT who has been acting as Executive Director since September 1939 succeeds Mr. Beaumont as Managing Director.

PHILLIP M. ROBINSON, chief engineer, Pennzoil Company, was appointed in December to serve as assistant to Dr. Robert E. Wilson on the National Defense Advisory Commission. Mr. Robinson replaces C. C. Monrad who returns to Carnegie Institute of Technology and who will act only in a consulting capacity to NDAC. Mr. Robinson's duties will be mainly in connection with the refining branch of the industry.

Allied News-Photo

Clair G. Irish

CLAIR G. IRISH, executive of the Standard Francaise des Petroles, French affiliate of Standard Oil Company of New Jersey, is sailing on the SS. Exeter of the American Export Lines on January 11th. Mr. Irish has been in New York for the past three months and is returning to his post in Paris.



Herbert Hoover being escorted to the directors box at the Metropolitan Opera by W. S. S. Rodgers, president of The Texas Company at the beginning of a new opera broadcast series sponsored by The Texas Co.

LEYLAND E. HAWKINS, captain of the tanker Associated, has been awarded the Order of the Rising Sun by authorization of the Emperor of Japan, which is the highest decoration presented by the Japanese to a citizen of another country. The Rising Sun was awarded in recognition of Captain Hawkins' gallant rescue of 209 crew, officers and passengers from the burning Japanese liner Bokuyo Mayu on July 17, 1939, in the Pacific Ocean.

George H. Taber

GEORGE HATHAWAY TABER, retired vice-president of the Gulf Oil Corporation, died at his home in Pittsburgh on December 10. Mr. Taber was born January 20, 1859, in Fairhaven near New Bedford, Mass.; his ancestors settled in New England at a very early date and had long been identified with seafaring and whaling. He entered the petroleum-refining industry in 1882 at the Queens County Oil Works in Brooklyn, one of the units of the original Standard Oil Co. In 1903 he became general manager of the Gulf Refining Co. and, later, vice-president in charge of manufacturing It was in this position that he had a particularly intimate part in the founding of Mellon Institute.

Mr. Taber retired from active business in 1928, devoting his time to completing his collections of paintings, Chinese jades, and porcelains. He was a man of great energy and personal charm, and always entertained a very high conception of the dignity and significance of scientific work.

L. A. Gibbons

B. H. VAN DER LINDEN, manager of production for the Royal Dutch Company, recently arrived in the United States and is making his headquarters at the Shell offices in New York.

STUART A. GIRAUD, director of Humble Oil and Refining Company and manager of its sales and manufacturing operations, died on Saturday December 21 at his home in Houston, Texas. He was 53 years old. While he had been ill of pneumonia it was not realized that the attack was critical and word of his death was a surprise to his friends in the industry. Mr. Giraud entered the oil business when the great Spindletop field was discovered in Texas soon after the turn of the century. He studied accounting and joined the Humble in 1916 as auditor and general assistant to the president. In 1932 he was appointed sales manager and the following year became chairman of the manufacturing and marketing committees. In 1936 refining operations were added to his responsibilities. Mr. Giraud is survived by his wife.

G. H. FORD, for many years chief timer at the Indianapolis Motor Speedway, has been selected as head of Marmon-Herrington's new Test and Proving Division.

Buell Jones

L. A. GIBBONS, of Los Angeles, general counsel of the Union Oil Company of California, and BUELL F. JONES, of Chicago, general counsel of the Standard Oil Company (Indiana), have accepted membership on the American Petroleum Industries Committee. The appointment of both men was made at the last meeting of the board of directors of the American Petroleum Institute.

© International News Photo

William Rhodes Davis, who has received extensive publicity in the daily press as a result of statements by Verne Marshall that Mr. Davis was the bearer of a Nazi peace proposal. Mr. Davis has been interested in a refinery at Hamburg, Germany, in supplying the proposed Irish monopoly, in the export of expropriated Mexican oil and in producing properties in the United States.

A. L. WEIL, president of General Petroleum Corporation, recently retired and is succeeded by S. J. Dickey who has been associated with G. P. for 21 years. Mr. Weil, well known throughout the industry, has been connected with the company for over 30 years. Fred Isaacs, manager of General Petroleum's refineries, and R. L. Minckler, assistant to the president, have been elected to the Board of Directors.

W. HANSOT, for the last five years the advertising manager of Socony-Vacuum Oil Company in Paris, has joined the Aridye Corporation, Fair Lawn, N. J., in a merchandising capacity. Mr. Hansot served recently as an officer in the French Army. He was formerly associated with the Blackman Company advertising agency in New York.

DONALD A. ROBINSON has been appointed vice-president of the Caterpillar Tractor Company with administrative direction of all selling and advertising activities. He will be succeeded as general sales manager by Gail E. Spain, formerly manager of the sales development division.

NEW YORK CHAPTER of the Nomads met at Sherry's, Monday, January 6, to elect new officers for the year 1941. The election resulted in J. A. Thomas becoming the new president, succeeding John H. Baird. Russel D. Heath was elected vice president, H. B. Cheswick secretary, Walter S. Fellows,

assistant secretary; Fred Convers, treasurer and W. H. Seims, assistant treasurer. Howard Book and F. J. Olson were elected respectively sergeant-at-arms and assistant sergeant-at-arms. John H. Baird and J. A. Thomas are members of the National Board of Regents.

JOHN A. LLOYD, who has been with the overseas sales department of the Sun Oil Company, Philadelphia, Pa. for many years, has been appointed director of its Foreign Sales Department, succeeding F. J. Coffin who has retired for reasons of health.

Price Signs at N. Y. C. Gasoline Stations.

IT IS too early to prognosticate if the steps taken by the city of New York to limit the size of price signs at gas stations will spread over the country now that the Court of Appeals of the state of New York has ruled the city's act to be legal. Warnings have been issued by the Bureau of Weights and Measures to station owners and lessees to the effect that no sign shall be larger than 12 by 12 inches or less than 7 by 10 inches and to be displayed over the pump only, under threat of prosecution. About 5,000 gasoline retail outlets are effected.

It is believed in some quarters that, regardless of many reasons against such drastic municipal interference with gasoline retailing, the measure will do much to reduce the number of undesirable price wars should the practice set by New York eventually expand to hundreds of cities and towns throughout the United States.

The first rotary drilling rig in the world, illustrated above was first used by Nick Parrish to drill wells in the Corsicana, Texas area in 1896. The ancient rig has been preserved and was recently exibited at Corsicana. A one horse power unit, it coaxed the bit in a leisurely manner to depths of 1,000 to 1,200 ft.

WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Petroleum Industry, Edited by Dr. O. W. Willcox

DRILLING

Combating Loss of Circulation in Drilling and Cementing—J. B. Stone in OIL AND GAS JOURNAL, vol. 39 (1940), No. 13, pp. 44-45.

Recently there has been inaugurated a new method for preventing loss of cement slurry or drilling mud into porous formations and for regaining lost mud circulation. The method employs a flaky organic material called Jelflake, which is mixed in relatively small proportions into the cement slurry or mud. Its use has been phenomenally successful in the field. Extensive laboratory and field tests have demonstrated superiority of this material over other substances commonly used to plug highly permeable formations.

The material is a chemically inert product, fabricated into small paper-thin particles. It is not deteriorated or softened materially by water, oil, mud or cement slurry; and the flakes are tough and strong even when wet. These flakes are treated by a special chemical process in order to give them a crinkled surface so that they will not adhere to each other when mixed with mud or cement slurry. Since Jelflake has a density quite close to that of mud, it will remain suspended indefinitely in mud or cement slurry.

Because of their extreme thinness, the flakes are flexible and pliant. This property enables them to cover the irregular and rough surfaces of a porous formation. When cement slurry or drilling mud in which the material has been mixed enters such a porous thief formation, the flakes are strained out. In this manner there is built up on the face of the formation an impervious wall.

CHEMISTRY

Determination of Bromine Addition Number—Karl Uhrig and Harry Levin, The Texas Company, Beacon, N. Y., before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

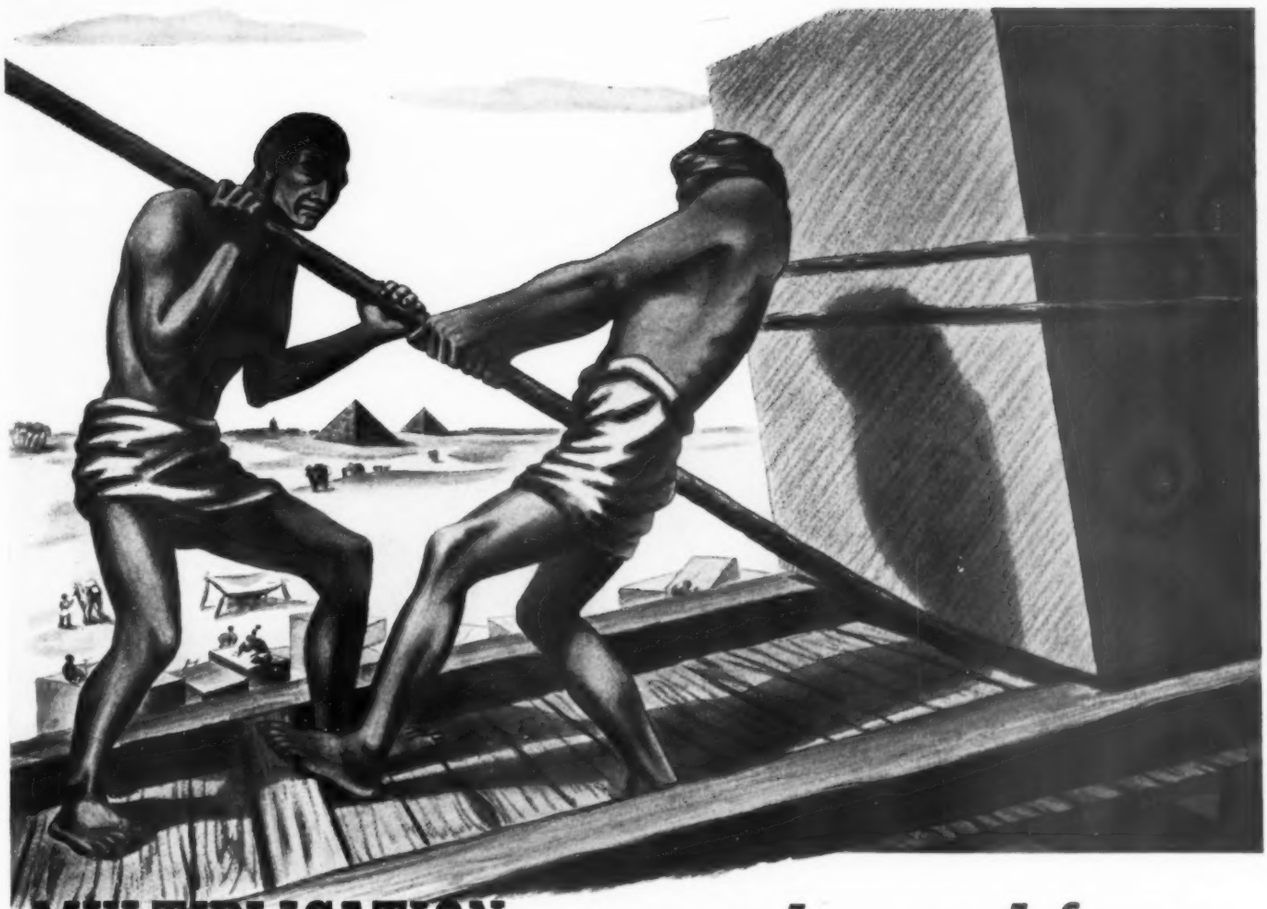
A method is described for determining degree of unsaturation quickly, by direct titration of sample dissolved in chloroform with a standard solution of bromine in glacial acetic acid, using the color of the bromine itself as indicator. It has given correct results when applied to pure hydrocarbons of known unsaturation, such as cyclohexene, di-isobutene, triso-butene, etc., and reproducible results on unknowns. It was found that the solvents used in the analysis are factors affecting the results.

There is evidence that the method will find utility in fat analysis.

USE

The Mechanism of Wear Prevention by Addition Agents—Otto Beeck, J. W. Givens, A. E. Smith, and E. C. Williams, Shell Development Co., Emeryville, Calif. before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

Using the four-ball bearing both for friction and wear studies, wear prevention agents could be segregated into two classes: wedging agents and chemical polishing agents. Wedging agents comprise those long chain polar compounds which electron diffraction experiments show to be adsorbed on the metal surface to form highly



MULTIPLICATION . . . *speed . . . and force*

The human race has survived . . . and ascended . . . solely through its ability to multiply speed and force by mechanical means.

The lever . . . the wheel . . . the inclined plane represented the early efforts. In search for means for translating power, man found that he could not only multiply the effectiveness of his own strength, but external natural forces as well . . . including the force of gravity.

Little more than a generation ago the first hesitant attempts were made to generate and harness Centrifugal Force for industrial processes . . . and for research problems.

Now Centrifugals are available for a wide range of varied applications . . . with a separating force of 13,000 times gravity, for commercial work . . . 250,000 times gravity for research.

THE SHARPLES CORPORATION

SHARPLES

Representatives throughout the world

★ *CENTRIFUGAL AND PROCESS ENGINEERS* ★

2323 WESTMORELAND STREET · PHILADELPHIA · PA.

LONDON PARIS TOKIO

NEW YORK BOSTON PITTSBURGH CLEVELAND DETROIT

CHICAGO DALLAS SEATTLE SAN FRANCISCO LOS ANGELES

oriented layers with the carbon chains perpendicular to the surface. Their presence produces a more rapid transition from boundary lubrication to quasi-hydrodynamic lubrication. Chemical polishing agents increase the load bearing surface by corroding off the high points which initially carry the load. Their effectiveness is largest when they form compounds which can combine with the surface to form low melting alloys. Wear reduction factors up to 7 (as compared with white oil) have been found for chemical polishing agents, wear reduction, and factors up to 17 for combinations of chemical polishing and wedging agents.

The Use of Additives in Automotive Lubricants—F. L. Miller, W. C. Winning, and J. F. Kunc, Standard Oil Development Company before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

For best performance lubricating oils should have proper volatility, viscosity, stability, oxidation and corrosion resistance, detergency, and lubricating characteristics. In recent years synthetic addition agents have found wide use as means of obtaining these qualities by supplementing conventional lubricating oil refining. Pour point depressants to lower solidification temperatures, thickeners to improve viscosity-temperature relationships, oiliness agents to aid lubricating properties, antioxidants to increase resistance to oxidation and bearing corrosion, detergents to improve engine cleanliness and reduce sludging, and many other special compounds have been developed and utilized. Modern gasoline and Diesel engines, particularly under heavy-duty operating conditions, have created lubricating problems making these special additives essential for satisfactory performance.

Use of Small-Scale Single Cylinder Engines for the Evaluation of Motor Oils—A. O. Willey and C. F. Prutton, before SOCIETY OF AUTOMOTIVE ENGINEERS, White Sulphur Springs Meeting, June, 1940.

The paper starts off with general review of the conventional laboratory methods of examining motor oils, and then mentions a few modifications of well known methods as used in their laboratories. One is a modification of the Indiana test which they call the Continental Oxidation test. It consists of subjecting the sample of oil to heating at 341 deg. F. in contact with a coil of iron wire suspended in the oil. Air is passed through the oil sample at a rate of 10 liters per hour as in the Indiana test. At various intervals during the test, the oil is checked for viscosity increase, naphtha insolubles, and Conradson Carbon Residue, by the conventional ASTM methods. Results of this test are expected to be indicative of rates of viscosity increase and sludge formation in engine service.

For making motor oil corrosion tests they use a procedure (developed by The Caterpillar Tractor Co.,) which consists of rotating a test specimen of bearing metal in a bath of oil held at a fixed temperature for 65 hours. The bearing metal is attached to a fiber rod used as the drive shaft to eliminate the effects of electrolysis. The amount of corrosion is measured by loss in weight of the test specimen.

There remain three important service properties of a motor oil which have not yet been successfully evaluated by simplified laboratory test methods. These are the properties of detergency, ring-sticking and varnish-formation. For information on these, some sort of engine test is still necessary. The use of full-scale engines in laboratory block tests is impracticable for thorough testing of all phases of oil behavior. The next possibility is a bank of single-cylinder liquid-cooled engines with a 2⅝-in. bore and 2½-in. stroke rated at 2½ h.p. at 1800 r.p.m. The authors describe their experiences with such engines, and find that their results correlate fairly well with field and road experience as well as with large-scale engine results. When operated with a cooling jacket temperature of 170 deg. F. and oil sump temperature of 280 deg. F., conditions are provided for forming varnish with poor anti-varnish oils in as short a period as 25 hours. The ability of these small engines to show up ring-sticking and corrosive tendencies of oils is also satisfactory.

An Instrument for the Continuous Measurement of Piston Temperatures.—A. F. Underwood and A. A. Catlin, before SOCIETY AUTOMOTIVE ENGINEERS, White Sulphur Springs, June, 1940.

One of the outstanding problems in the construction of internal combustion engines has been to find a means of measuring the temperature of the pistons of these engines while in operation. This information has been desirable for two principal reasons. One is to learn the temperatures at which the metal of the piston begins to be seriously affected and the other is to obtain an insight into the behavior of the motor oil under the actual temperature conditions of operation; such knowledge will open the way to control of the operating conditions, and give a better understanding of the causes of ring sticking and carbon formation on the under side of the piston.

The apparatus finally developed consists essentially of thermo-couples built into the piston at various points for registering the indications of these thermo-couples by a galvanometer arrangement.

The arrangement was used for extensive tests on an engine of 3¾ in. stroke on which oil stability tests were being run. The effects of engine load and speeds of the piston were determined on each of three gasolines of 57, 70 and 87 octane number. It is shown that increases in load up to about three-fourths of full load raises the temperature of the piston and beyond that the temperature falls somewhat. The higher the octane number of the fuel the lower the piston temperature the difference at ¾ load may be 12 deg. to 16 deg. F. Also, the temperature rises rapidly with spark advance except on 87 octane fuel. It is also shown that a jet of lubricating oil impinging on the underside of the piston head has a cooling effect. In its present state of development the apparatus is well adapted to study oil stability at definite temperatures.

Highly Aromatic Petroleum Solvent Naphthas—W. J. Sweeney and E. H. McArdle, Standard Oil Development Company, before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

The production of petroleum is so great that this material is unquestionably the most economic source of many types of hydrocarbons. Aromatic solvent naphthas represent one type of hydrocarbon concentrate already being produced from petroleum in appreciable quantities. While at present manufactured by physical methods of separation from virgin naphthas, increased quantities can be produced by the application of various hydrocarbon conversion processes. Analysis of commercial aromatic naphthas produced from petroleum has shown aromatic contents ranging from 70 to 90 percent, the principal individual components being toluene, ethyl-benzene, xylenes, and mixed C_9 and C_{10} aromatic hydrocarbons and the distribution depending on the boiling range to which the naphthas are cut. Tests made to evaluate the applicability of these aromatic naphthas to coating compositions indicate them to be in general equal in solvency and superior in stability to products derived from coal-tar distillates.

Highly aromatic petroleum solvent naphthas of this type with sufficient purity for the most exacting coating requirements can at present be economically manufactured from only a comparatively few domestic straight-run petroleum naphthas. When it is considered, however, that in 1937—a year of abnormally high coke oven activity—only twenty million gallons of toluene, four and one-half million gallons of xylene, and six million gallons of coal tar solvent naphtha were produced in this country, and that during the same period twenty-two billion gallons of gasoline were produced, it is seen that petroleum provides a large reserve of aromatic hydrocarbons against future demands, or in time of national emergency.

The Effect of Temperature on the Consistency of Lubricating Greases—W. A. Lutz, Gulf Research & Development Company before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

The characteristics of a number of representative greases of various types were determined on a modified Bingham plastometer. The yield values of the greases were determined by extrapolation on logarithmic coordinate paper while apparent viscosities were calculated from the Poiseuille equation for purposes of comparison. An example of slippage or plug flow is discussed.

Structural changes in all greases are evidenced by sudden changes in the slope of the apparent viscosity-temperature curve. In certain temperature ranges, sodium and aluminum base greases show increases in apparent viscosity with rising temperature due to their transition from plastic solids to viscous liquids of anomalous viscosity characteristics.

Better Fuels for Better Engines—William H. Hubner, before SOCIETY AUTOMOTIVE ENGINEERS: White Sulphur Springs Meeting, June, 1940.

As the supplier of fuel energy for highway transportation, the petroleum refiner has the problem of producing gasolines on a mass production basis which will be satisfactory in many types of engines operated under widely different driving conditions. This problem is complicated by the complex chemical and physical characteristics both of the raw materials with which the refiner must work and his finished products.

The paper reviews the refiner's solution to this problem from the viewpoint of the transportation and maintenance engineer, and discusses the trends of the major characteristics of gasoline, namely, volatility, antiknock quality, sulfur content, gum content and chemical composition. It suggests that the design of future engines will be in the direction of units of smaller size, having higher compression ratios, yielding higher power output and greater fuel economy, and requiring fuels of higher antiknock properties. It seems probable that in the future more emphasis will be placed on improving economy as well as on improving performance. It indicates that, although the trend has been toward more volatile fuels, apparently a leveling off point has been reached. The importance of low gum content and good

A single contract— a single responsibility

for buildings . . . processes . . . equipment in a CHEMICO Acid Recovery Plant

CHEMICO services . . . plants . . . guarantees . . . are COMPLETE, for CHEMICO assumes full responsibility of every detail in the selection or origination of processes and equipment, the design and construction of buildings, and the performance of each element of the entire plant.

Moreover, CHEMICO recommendations are AUTHORITATIVE, because they are made by leading specialists in acid production and recovery, with 26 years of experience in process development, backed by unequalled resources, and guided by the operating records of highly successful plants which are serving a wide variety of requirements all over the world.

The CHEMICO engineers are prepared to offer recommendations on the design of new or the remodeling of old plants for acid production, recovery, and concentration in large or small quantities. A preliminary discussion with our engineers involves no obligation.

CHEMICO
CHEMICAL CONSTRUCTION CORP.

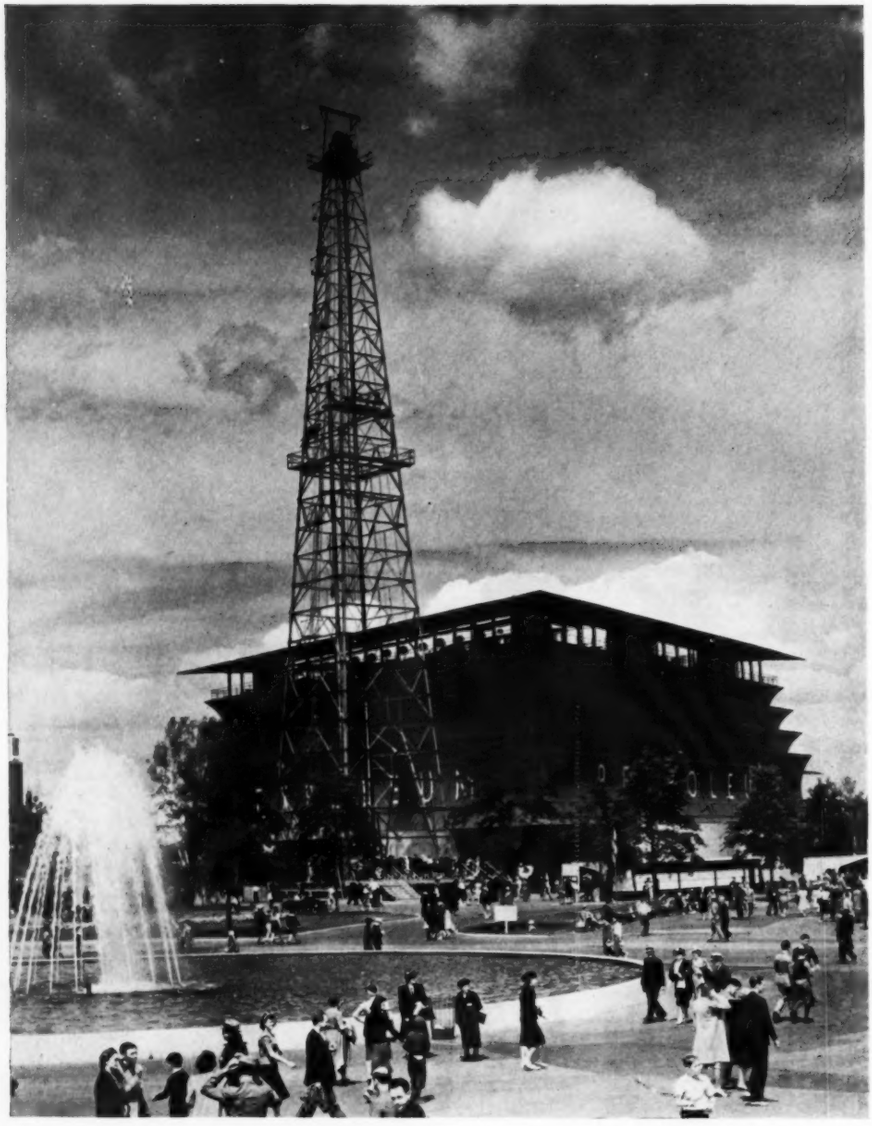
CHEMICAL CONSTRUCTION CORPORATION

MAIN OFFICES: 30 ROCKEFELLER PLAZA, NEW YORK

Cables: Chemiconst, New York

European Representatives: Cyanamid Products, Ltd., Berkhamsted, Herts., England

CHEMICO PLANTS are PROFITABLE INVESTMENTS



1940: ***Saw final closing of New York World's Fair with its striking petroleum exhibit, called forth widespread public attention, many startling questions.***

storage stability is stressed. Sulfur content is becoming less important as far as corrosion problems are concerned, and reduction in sulfur is largely a problem of the economics of producing high octane fuels. The paper describes the composition of modern fuels and the new refining methods of polymerization, catalytic cracking, catalytic reforming and alkylation.

However, the engine designers have a wide, proven margin for effecting economies in automotive operation. In aircraft design it has been demonstrated that a supercharged engine can utilize fuel of as high an antiknock value as may be available. There is a good chance that the future may see this development followed extensively in automotive design, although little has been done except for special purposes. Laboratory tests on an eight-cylinder valve-in-head engine showed that, with a 10 to 12 octane number improvement in the fuel, it was possible to almost double the maximum horsepower by supercharging.

Behavior of Gasoline-Coal Fuel in Spark-Ignition Engines—J. E. Hedrick, in REFINER, vol. 19 (1940), No. 8, pp. 73-74.

From time to time it has been suggested that mixtures of petroleum and pulverized coal be used in internal combustion engines. This subject has received more attention in Europe because of the scarcity of motor fuels, but the suggestion has been put forward also in this country as a step in petroleum conservation. However there has been but little investigational work.

The author undertook to get some data on actual engine performance where a gasoline-coal suspension was used as a fuel and to compare the results obtained when using gasoline alone. The gasoline-coal mixture had a specific gravity of 0.7234 at 60 deg. F. The fuel contained 2 percent by weight of coal of a particle size ranging from 1 to 74 microns. The engine used was a 4-cylinder automobile engine. With gasoline alone there was no detonation even at maximum load but with the gasoline-coal mixture the detonation at maximum load was very prominent. At constant speed the behavior as regards knocking was very erratic. Naturally the engine developed less power when the mixture was burned.

Coke was deposited in large flakes over the entire surface of the engine head. This is understandable, as a spark-ignition operates with less than theoretical air. The lubricating oil was in an extremely bad condition. However, it is surmized that similar oil-coal mixtures might work satisfactorily in Diesels.

Synthesis of Lubricating Oils by Condensation Reactions—W. R. Wiggins, T. G. Hunter and A. W. Nash, in JOURNAL INSTITUTE PETROLEUM, Vol. 26 (1940), No. 199, pp. 225-234.

Two synthetic lubricating oils were made; one of these was obtained by condensing chlorinated paraffin wax and benzene with an alumina catalyst and the other by condensing the same materials by means of aluminum chloride as the catalyst. The engine characteristics of these synthetic products were determined in comparison with a well established good commercial lubricating oil. The points taken into consideration were engine wear, oil consumption, carbon deposits, and condition of the oil in the crank case. The engine was operated in each test for the equivalent of a run of 1,500 miles at 40 miles per hour and the whole "mileage" was in excess of 20,000. The general result was to show that the synthetic oils compare favorably with the natural product.

Note—No indication is given as to whether the synthetic lubricants can be commercialized.—Ed.

BOOKS

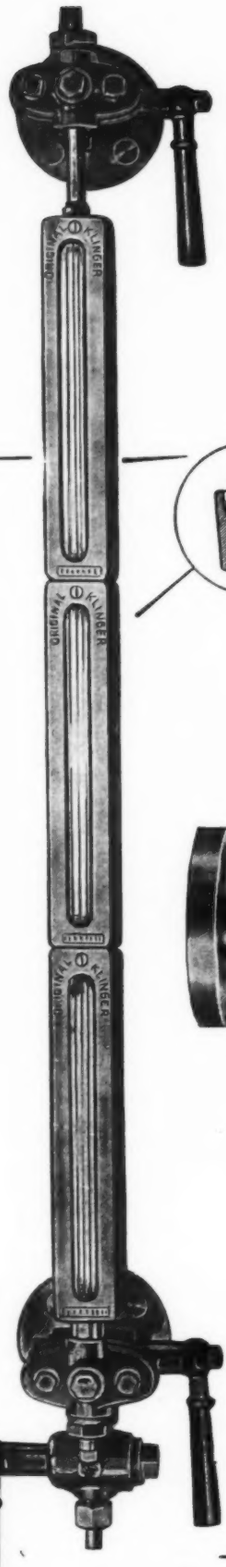
Tanker Technique, edited by B. Orchard Lisle and published monthly by WORLD TANKSHIPS PUBLICATIONS, New York; $2.50.

According to announcement in the first issue (August 1940) this new journal has been established to fill a vital need of the marine oil-carrying trade, which has now become too large and too important to be adequately represented by infrequent articles in other journals devoted mainly to the petroleum industry or to general marine commerce. It will have a vigorous editorial policy with a view to influencing opinion against sporadic construction programs and ultimately effecting a stabilized tanker freight market, particularly in the chaotic conditions likely to come at the end of the war. It promises strenuous opposition to unjust legislation and unfair business practices, and generally to afford the trade a medium for discussing its problems.

The first number, which appears without advertisements, contains a variety of articles of interest to tanker men, and interesting classified information.

Mineral Map of Europe compiled by the Geological Department of THE PURE OIL CO., Chicago, Ill.; 62 pages; cloth; maps and tables; $3.50.

A helpful compilation of data, taken chiefly from the "Foreign Minerals Quarterly" and the "Minerals Yearbook" of the Federal Bureau of Mines for the purpose of conveniently answering questions as to the location of Europe's mines and oilfields, Europe's proportion of world production, and Europe's estimated reserves. Full-page tables present figures, both by countries and by minerals, so that the reader may obtain at a glance accurate data on coal, oil, natural gas, iron, copper, lead, zinc, gold, silver, antimony, magnesite, pyrite, asbestos, uranium, mercury, potash, lignite tungsten, molybdenum, platinum, chrom-



"Klinger"

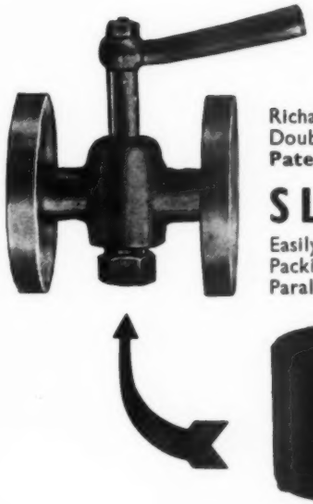
REFLEX AND THRU' VISION LEVEL INDICATORS . . .

The Reflex Level Indicator illustrated is of forged steel construction throughout, with stainless steel trim.

Among its special features are :

- Rigid box-shaped Forged Steel Gauge Body.
- Reflex Gauge fitted with one row of tightening bolts only.
- Separate Glasses easily removable.
- Automatic safety shut-off balls at top and bottom.
- Easily detachable stuffing-box heads for removing gauge as a complete unit.
- Gauge can be turned to face any direction.
- Klinger patent " SLEEVED-PACKED " shut-off and drain cocks.

Richard Klinger Ltd., are specialists in all types of LEVEL GAUGES including Double Plate (Thru-Vision) Type, Steam Heated Gauges and the **Hubbard Patent Gauge for LIQUEFIED GASES** (Butane, Propane, etc.).



SLEEVE PACKED COCKS

Easily renewable compressed asbestos packing sleeve.
Packing can be re-tightened while in service.
Parallel plug that cannot jam or seize.

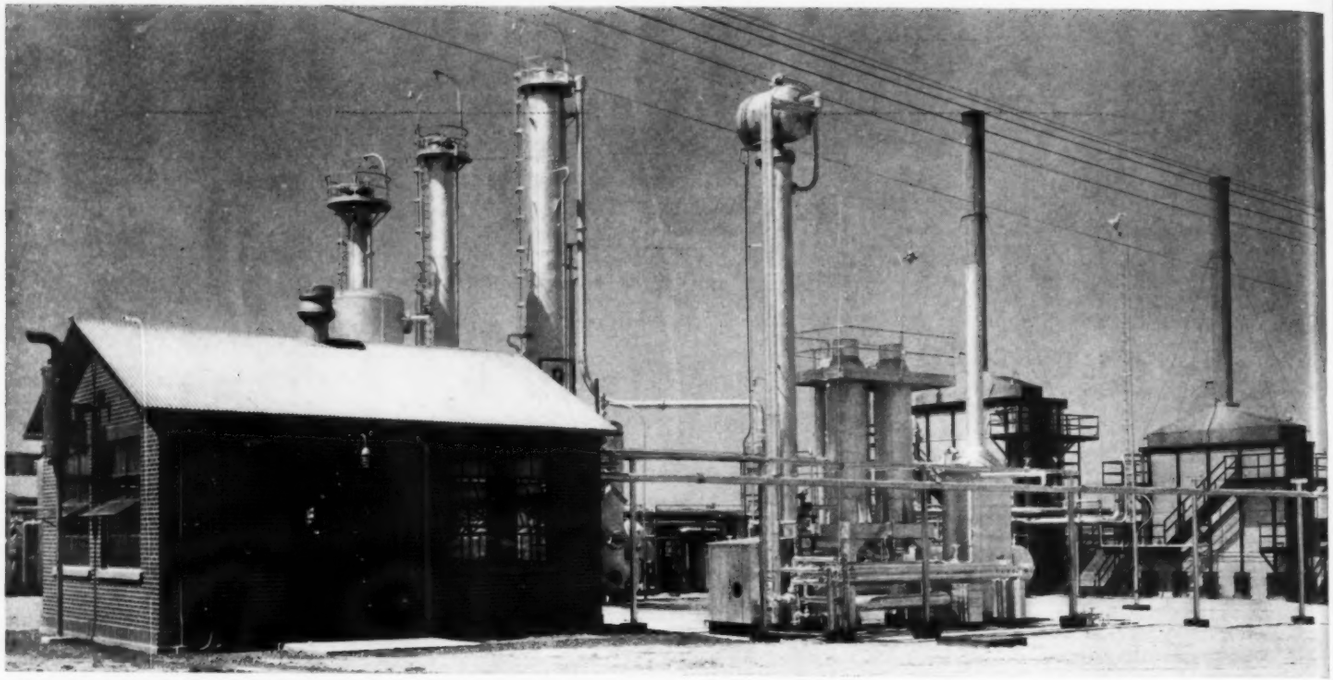
- Standard forged steel cocks with stainless steel trim suitable for pressure up to 1,200 lbs. per square inch.
- Special cocks available for 6,000 lbs. per square inch pressure.
- Working Temperatures up to 850°F.
- Unobstructed straight-through flow. Especially suitable for instrument connections and drains.
- Available as water gauge cocks, test cocks, superheater drains, air cocks, etc., etc.

PISTON TYPE VALVES

No seats to skim up.
No valves to re-grind.
No glands to re-pack.
Tightness maintained by easily renewable " Klingerit " valve rings.
Made in gunmetal for pressures up to 250 lbs. per square inch and in forged steel for pressures up to 1,200 lbs. per square inch.

Please write for Catalogue to :

RICHARD KLINGER LTD. · " KLINGERIT " WORKS · SIDCUP · KENT · ENGLAND



ium, tin, and bauxite. A 27 x 31 inch detached map, in four colors, shows producing areas. Edition limited to 1,000 copies.

The Aircraft Year Book for 1940, edited by Howard Mingos; published by AERONAUTICAL CHAMBER OF COMMERCE, New York; 532 pages; cloth; $5.00.

Twenty-second annual edition of this official record and reference work on American aviation, complete with statistical tables and aeronautical directory. The volume is of especial interest this year because of the analysis of war in the air in Europe and the extensive reports on development of military aviation in the United States. Results in Europe are mentioned as a tribute to German preparedness in the air, for the Allies a sacrifice to unpreparedness, and for the rest of the world a warning of the necessity of having an air striking force equal to that of the enemy, plus reserve power with which to maintain it. The air power of the United States is held to be "potentially the greatest in the world, if its rational development is carried on," and this country is said to have every opportunity to maintain its superiority in any emergency.

Practices and Methods of Preventing and Treating Crude-Oil Emulsions—By G. B. Shea, published as Bulletin 417 of THE BUREAU OF MINES, Washington; 106 pages; 30 cents.

This compact publication exhaustively deals with the emulsions of water and oil which always have constituted one of the most serious forms of waste in the oil fields, and which create the engineering problem of dehydrating emulsified crude petroleum to obtain marketable or pipe line oils.

The problem is a baffling one because each emulsion and the conditions under which it is formed present an individual problem. No one preventive measure will prove effective or economical in all cases. Hence each case must be studied by itself. The author has provided a treatise that elucidates the known causes of emulsions and known ways in which they have been successfully treated. The petroleum engineer who has an emulsion problem on his hands may find in this book much that will be useful to him.

1940: ***Saw the launching of a number of surveys designed to establish the ability of the industry to supply military requirements of iso-octane gasoline. Wood River, pictured below, was the principal producer of this type of motor fuel before the defense effort got under way.***

Petroleum Development and Technology (1940). Volume 136. Edited by the Petroleum Division of the AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS; 608 pages. $5.00.

This volume is the fifteenth of the Petroleum Development and Technology Series of the Petroleum Division A. I. M. E. and contains papers presented before the Division at various meetings during the past year. There are, as usual, five chapters: (I) Production Engineering; (II) Engineering Research; (III) Petroleum Economics; (IV) Production, Domestic and Foreign and (V) Review of Refinery Engineering.

The production engineering papers relate to gravel packing; stabilization of crude, well spacing, radial filtration of drilling muds, and radioactive cement in cased wells.

The papers on engineering research are concerned with flow of air-water mixtures in pipes, flow of gas-liquid mixtures through unconsolidated sand, phase diagram of natural gas and natural gasoline near the critical point, fundamental phase behavior of hydrocarbons, pressure-volume-temperature relations of liquids and gases, volumetric behavior of isobutane, temperature relations of rotary drilling muds, chemical control of clay suspensions, dispersion of clays and shales by fluid motion.

The authors of papers on petroleum economics discuss over-development, the refiner's choice of crudes, dynamics of the domestic demand for motor fuel, and world consumption of petroleum and related fuels.

The chapter on production continues the statistical information on the production of the 26 recognized producing areas of the United States and 15 foreign countries. Missing from the foreign list are the Axis powers, Iraq, Egypt and various other small producers.

The chapter on refinery engineering covers 5½ pages, which briefly mention the "octane race" and the measures being pursued to get around the law of diminishing returns affecting tetraethyl lead; catalytic reforming, polymerization, alkylation, desulfurization, Diesel fuel, lubricants, wax, and recent trends in the use of petroleum as a raw material for chemical manufacturing.

GENERAL

Future Needs in Fuel Oil for Motor Transport. T. A. Boyd, before AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

Estimates are cited to show that the total number of motor vehicles in use in the United States will increase about 30 percent during the next twenty years to 37,000,000, while the gasoline consumed will increase 20 percent to 25,000,000,000 gallons. The smaller proportionate increase in gasoline relative to motor vehicles in use is justified by the prospect that miles per gallon will be greatly improved in the future. Mileage per gallon has not been increased more rapidly in the past, due to the demands of car buyers for continually higher and higher performance—greater accelerating capacity and hill-climbing ability. Performance of gasoline has been boosted since 1927 by about 45 percent, while economy, in terms of ton miles per gallon, has been improved by an average of 20 percent. Only incidental improvement in economy can be obtained when the primary objective is to boost power.

It begins to appear that from now on the car users may prefer to take the benefits of further improvements in fuels and of advances in engineering in terms of more miles per gallon. If so, one of the advances that would greatly aid in making higher fuel economies possible would be further increases in the octane number of gasoline. Experiments with 100 octane number gasoline instead of the 70 octane number type have shown a 55 percent increase in miles per gallon at 20 miles an hour, and more than 40 percent increases at higher speeds, with important gains in performance. By raising the compression of a conventional car engine to a ratio of 10.3:1 and using a fuel something above 100 octane rating, the gains in mileage per hour were about 70 percent at 20 miles per hour, 65 percent at 40 miles an hour, and approximately 50 percent at 60 miles an hour. From an altogether knock-free fuel, it would not be hard to get either double the power or nearly twice the mileage per gallon, but not both at once. Such a fuel should make possible an engine of much smaller displacement than that of today. If with 100 octane number gasoline, miles per gallon could be increased only by 50 percent, the saving to the car user would amount to one-half of the present retail value of fuel.

It is in the aircraft that the most can be gained from increases in octane number, because with suitable changes in power plants larger pay loads are made possible. It has been estimated that the earning capacity of airplanes in long-distance or transoceanic service can be increased to offset additional costs of from two cents to eight cents per gallon for each octane number of improvement above 73.

The maximum mean effective pressures of aircraft engines using the best commercial fuels of the time have jumped from 125 pounds per square inch in 1930 to 200 pounds and more today now that 100 octane-number fuel is available. But mean effective pressures as high as 600 pounds are said to have been obtained in small engines with special non-commercial fuels. It thus seems reasonable to suppose that the need for higher horse-powers per pound in aircraft will stimulate the production of aviation gasolines of still higher degrees of freedom from knock, as well as the development of power plants capable of using such fuels to advantage.

The future of high-flash aviation gasolines and diesel fuels for automobiles is difficult to foresee. To whatever extent such fuels may be found useful, it will require high-octane hydrocarbons boiling at 300 degrees Fahrenheit to give the necessary flash point of about 105 degrees. Such high-boiling, knock-free hydrocarbons are not plentiful in nature.

World Registration of Motor Vehicles—Etteline Flehr, in AUTOMOTIVE WORLD NEWS, Vol. 2, (1940), No. 13, pp. 117-131.

According to the best information available, the number of motor vehicles in use on January 1, 1940, reached a record total of 45,422,411 units, an increase of 1,602,482 units or 3.5 percent over the 43,078,630 units registered a year ago, when the number in use showed an increase of only 1.7 percent over registrations as of January 1, 1938. Of the motor vehicles in world operation, over 68.5 percent are in the United States and territories compared with 68.3 percent on January 1, 1939.

Registrations in all types of vehicles showed increases in both totals, that is for the United States and non-contiguous territories and countries outside the United States. At the beginning

LECITHIN

THE ADDITIVE FOR STABILIZING GASOLINE AGAINST CLOUDING, FADING OR OCTANE LOSS

The introduction of LECITHIN into both leaded or unleaded gasolines improves the gasoline quality, maintains octane number of leaded gasolines, stabilizes color and minimizes corrosion of steel or aluminum storage.

Comprehensive and conclusive research developed the use of Lecithin as the best material for these purposes.

LICENSES ARE OFFERED TO ALL REFINERS

U. S. Patent Numbers	Canadian Patent Numbers
1,884,889	364,658
2,155,678	364,659
2,165,651	British Patent Number 464,055
2,208,105	South African Patent Number 116/35
	Australian Patent Number 25,165

THE GLIDDEN COMPANY

Drawer "B"

ELMHURST, NEW YORK, U. S. A.

of 1940, motor vehicles in operation in the United States proper included 26,210,486 (25,264,260 on January 1, 1939) passenger cars; 156,996 (156,237) buses; 4,637,388 (4,427,413) trucks; and 5,000 (5,000) Diesel units or a total of 31,009,870 (29,852,910) vehicles. Adding the number of motor vehicles in use in non-contiguous territories (Alaska, Hawaii, Puerto Rico and Virgin Islands), brings the totals for the United States to 26,284,676 (25,334,225 on January 1, 1939) passenger cars; 157,675 (156,927) buses; 4,657,767 (4,446,164) trucks; and 5,000 (5,000) Diesel vehicles or a grand total of 31,104,118 (29,942,316).

Reports from countries outside the United States show that the following motor vehicles by types were in use on January 1, 1940 (figures for January 1, 1939 in parent heses); passenger cars 10,282,057 (10,090,701); buses 317,349 (266,349) trucks 3,544,353 (3,390,512); and Diesel units 174,534 (130,051); a total of 14,318,293 (13,877,613).

The use of Diesel trucks and buses in countries outside the United States and territories showed a further increase of 34 percent, totaling 174,534 vehicles on January 1, 1940, compared with 130,051 on January 1, 1939. Some of the larger users of Diesel vehicles are Germany (69,700 units), Italy (46,750), France (18,500) and the United Kingdom (14,000).

The article gives detailed statistics for some 200 countries or areas throughout the world.

Coal or Oil from Molasses and Other Vegetable Materials— Ernest Berl, before AMERICAN CHEMICAL SOCIETY, Detroit, Meeting, September, 1940.

Announcement is made of the production of crude oil, bituminous coal, asphalts and coke from grass leaves, molasses, seaweed, wood, corn or cornstalks, and an attempt will be made to produce anthracite. Contrary to previously held views that true bituminous coals are formed for the most part from the lignin content of vegetable materials, it is now regarded as proved that such coals are mostly formed in nature from the carbohydrate contents of plants. It is also said to be proved that asphalts are the parent material of crude petroleum. These transformations have been effected in the laboratory within an hour, which might also happen in nature if the conditions were right.

The proposition has little commercial promise at the present time, but it holds out the prospect of a future supply of petroleum products when the supply of raw materials accumulated in past geologic ages has been exhausted. Carbohydrates are producible as annual crops, thus assuring continuing production.

Naphthenic Acids. II. Manufacture, Properties, and Uses—Edwin R. Littmann and J. R. M. Klotz, Stanco Incorporated, before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September, 1940.

The expanding uses for naphthenic acids have made desirable a compilation of information regarding their occurrence, manufacture, composition, properties, analysis, and uses. The material presented in this paper is illustrative and organized according to the above subjects and has been collected mainly from the patent literature. Since, in a presentation of this type, a detailed discussion of every reference is precluded, a supplementary bibliography has been appended.

The Preparation of Pure Octanes—Cecil E. Boord and Albert L. Henne, Ohio State University, before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, Detroit, September 1940.

Pure hydrocarbons in batches of about seven liters have been synthetically prepared for examination of their behavior in internal combustion engines. All impurities have been carefully eliminated in order not to upset the knock measurements, particularly the lead response. The equipment has been built from simple standard parts, and the raw materials used have been easily available products throughout; the methods of operations and the resulting yields are listed. The purity of the final samples has been checked by inspection of the freezing curves. Separate measurements performed by the Bureau of Standards have confirmed the results, and their purity rating is appended. A list of the physical characteristics of eighteen synthesized hydrocarbons is given.

Hydrogenation of Oil: Suggested Natural Source of Petroleum—E. T. Heck in BULLETIN AMERICAN ASSOCIATION PETROLEUM GEOLOGISTS, vol. 24 (1940), No. 8, pp. 1475-1497.

In studying saline waters associated with petroleum the author has noticed reactions that apparently yield hydrogen. These reactions involve first the reduction of sulphate to sulphide and the fixation of sulphur in iron disulphide (pyrite). It is not known just how sulphate of lime (gypsum) is reduced, but it is thought that in the presence of organic matter the products of the decomposition include calcium carbonate and hydrogen sulphide (H_2S). The hydrogen sulphide will react with any iron compound that may be present, with formation of ferrous sulphide (FeS). This accounts for the presence of FeS in the buried black muds that are supposed to form in geological time the source beds of petroleum. Since pyrite, FeS_2, is perhaps the most common and authigenic mineral associated with petroleum it remains to account for the conversion of FeS to FeS_2. It seems most likely that the following reaction has occurred:

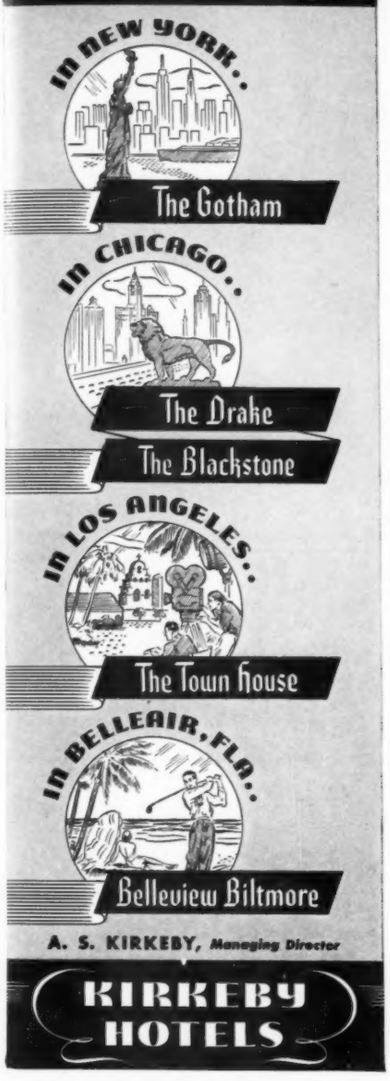
$$FeS + H_2S = FeS_2 + H_2$$

This hydrogen would hydrogenate the carbonaceous residues from decayed vegetable substance, and the result would be petroleum hydrocarbons. This hypotheses requires large supplies of iron and sulphates as well as vegetable matter, and there seems to be little doubt that the quantities of lime and gypsum needed for the purpose have been ample.

Proper Sealing of Abandoned Oil Wells Important in Mining Areas—F. R. Cozzens, in PETROLEUM ENGINEER, vol. 11 (1940), No. 12, pp. 104, 107.

Throughout the Allegheny coal regions there is a persistent belief that natural gas is a contributing factor in many mine fires and explosions. In the Willow Grove mine disaster of March 16, 1940, near St. Clairsville, Ohio, which cost the lives of 70 men, it was widely rumored that escaping gas from an abandoned well in that vicinity had filtered into the workings and been ignited from a friction spark or a miner's lamp. This rumor in the Willow Grove case, as in previous ones, was not borne out by thorough investigations by mining officials, but nevertheless, there are possibilities that can neither be disputed nor denied. Natural gas can, and often does, penetrate coal seams and other porous formations in the upper earth. We know also that natural gas can easily reach these upper formations from an improperly sealed oil or gas sand. As mine blasts are occurring with greater frequency in localities previously drilled for oil or gas, it appears probable that forthcoming revision of mining laws will require more rigid methods of sealing abandoned wells. Operators will be im-

A GRACIOUS HOST
FROM COAST TO COAST



A. S. KIRKEBY, *Managing Director*

KIRKEBY HOTELS

CLAYTON TANKS
FOR OIL STORAGE

IMPORTANT CONTRACTS CARRIED OUT IN—
GT. BRITAIN, FALKLAND IS.
GIBRALTAR, BERMUDAS
CEYLON

CLAYTON, SON & Co. LTD
HUNSLET LEEDS, ENGLAND
LONDON OFFICE: 2 VICTORIA ST. S.W.1

pressed with the fact that a sand is sealed not solely to exclude outside interference, but also to prevent elements within the sand-body from doing damage outside its scope. Fortunately, both effects may be obtained by the same operation.

An effective sand-sealing job can be done by approved methods, and thereby the operator will relieve himself of responsibility to mining interests and help protect his own industry.

Fire in the Bottom of an Oil Well—I. P. Sanders in OIL & GAS JOURNAL, vol. 39 (1940) No. 13, p. 46.

A fire intense enough to fuse a sand line near the bottom of a well in Oklahoma City is reported. To explain this fire the following theory is advanced: All offsets to this well were under 4 in. of vacuum at the surface when the fire occurred and were producing from 2,000 to 65,000 cu. ft. of gas per day. The upper section of Wilcox sand in the Sandness No. 1, is probably now drained of oil, leaving it in a very porous, yet semisaturated condition. When this well was opened at the surface the vacuum at the offsets started pulling air down the casing and into the porous saturated sand. Air in this sand combined with the gas vapors from the oil in the sand to form a combustible mixture which was ignited either by the heat of friction or from a spark that was created by the fishing tool. The vacuum pulling the air toward the offset wells drew the fire back into the sand, thus furnishing it with additional fuel.

While the bottom-hole fire complicated the fishing job somewhat by melting the sand line so that it was divided into a number of pieces, it probably did not cause any appreciable injury to the well. The incident is of interest mainly as a freak, but it does prove that subterranean fires are possible in oil pools.

High-Strength, Corrosion-Resistant Alloy Sheet.—Release of UNION CARBIDE AND CARBON CORP.

Recent data indicate that Hastelloy C in rolled form possesses remarkable strength and toughness for a material having such high resistance to chemical corrosion.

The ultimate tensile strength of rolled and annealed Hastelloy alloy C sheet is in the range of 115,000 to 128,000 lb. per sq. in., while its elongation in 2 in. is between 25 and 50 percent. Brinell hardness is between 160 and 210. Hastelloy alloy C sheets and plates are also now available in all commercial thicknesses and sizes up to 200 lb.

Hastelloy alloy C sheet, composed of nickel, molybdenum, chromium, and iron, has outstanding resistance to wet chlorine. Rolled forms are already being used in chlorinating equipment and other chemical plant equipment for handling strong oxidizing agents. At the same time, the alloy is resistant, within reasonable limits of temperature and concentration, to hydrochloric acid, metal halide solutions, and sulphuric and phosphoric acids.

Some of the mechanical properties of the alloy in the cast form are a tensile strength of 72,000 to 80,000 lb. per sq. in., an elongation in 2 in. of 10 to 15 percent and a reduction of area of 11 to 16 percent. Its normal heat-treated hardness is 175 to 215 on the Brinell scale. A special hard analysis of this alloy, with a hardness of 322 to 372 on the Brinell scale is now also available in cast form. Material of this analysis possesses the same high corrosion-resistance as material of the regular analysis, together with higher resistance to abrasive wear.

LEACH EXCHANGERS
for
High Temperatures
High Pressures

Fracto Control

High Heat Transfer
Low Vapor Pressure Drop
Long Tube Life
Easy Cleanability

Leach Exchangers are fully protected by U. S. and foreign patents

C. H. LEACH CO.
117 Liberty St. New York

RENOLD

Designed and made to A. P. I. specification by the world's leading driving chain makers.
Send for leaflet No. 216/32
THE RENOLD & COVENTRY CHAIN CO. Ltd.
MANCHESTER, ENGLAND
Agents throughout the world

STORAGE TANKS
any capacity
for OIL, PETROL, ETC.
ARC WELDED
We are experts in the designing, manufacture and erection of Welded Tanks.
COMPLETE INSTALLATIONS
Send us your Enquiries
OXLEY ENGINEERING CO. LTD.
HUNSLET LEEDS, 10 ENGLAND
Telephone LEEDS 27468/9 Telegrams: OXBROS LEEDS
LONDON OFFICE: Winchester House, Old Broad Street, E.C.2
Telephone: LONDON WALL 3731

CALIFORNIA TEXAS OIL COMPANY LTD.

★ ★ ★

PETROLEUM PRODUCTS OF UNSURPASSED QUALITY AND UNIFORMITY

. . developed by extensive refinery and research organizations . . . backed by years of efficient practical performance

Distributed in

Arabia, Australia, Bahrein, Ceylon, China, Dutch East Indies, East Africa, Egypt, French Indo China, India, Japan, Korea, Malaya, New Zealand, Thailand, Philippine Islands, South Africa

★ ★ ★

BAHREIN FUEL OIL AND DIESEL OIL

CONVENIENTLY LOCATED

MODERN MARINE TERMINALS INSURE PROMPT DISPATCH AT

SUEZ • DURBAN • COLOMBO • SINGAPORE
SHANGHAI • BAHREIN

EXPERT TECHNICAL SERVICE

OFFICES IN U. S. A.
130 East 43rd Street,
New York, N. Y.

Cable Address: "CALTEX, N. Y."